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4	5	("D352436" "0941192" "3540106" "3686982" "5165155").PN.	USPAT	2003/09/16 14:28
5	3	("3572189" "0717800" "2902759").PN.	USPAT	2003/09/16 14:44
6	16	3540106.URPN.	USPAT	2003/09/16 14:45
7	217	29/751.ccls. and connection and tool	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 14:53
8	22	("2907040" "2946368" "3094774" "3177567" "3267565" "3706219" "3732718" "3733674" "3994090" "4027368" "4450621" "4555847" "4589271" "4926685" "4951369" "5074031" "5074142" "5195352" "5509194" "5509291" "5842371" "5924322").PN.	USPAT	2003/09/16 14:49
9	6	("2519630" "2752812" "3157075" "3170345" "4526070" "5280716").PN.	USPAT	2003/09/16 14:51
10	8	("2445480" "3285107" "3360068" "4283933" "4561282" "4633558" "4794780" "4829805").PN.	USPAT	2003/09/16 14:52
11	172	29/758.ccls. and connection and tool	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 15:02
12	9	("2369180" "2786095" "3325885" "3711942" "4730385" "5211049" "5392508" "5546653" "5647119").PN.	USPAT	2003/09/16 14:54
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14	0	72/410.ccls. and connection and tool	USPAT; US-PGPUB; EP ; JPO; DERWENT; IBM_TDB	2003/09/16 15:03
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16	67	72/409.01.ccls. and connection and tool	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 15:07
17	8	("3212317" "3416212" "3571888" "3594887" "3732718" "3903725" "3931671" "4534107").PN.	USPAT	2003/09/16 15:05
18	34	72/409.14.ccls. and connection and tool	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 15:09
19	73	72/416.ccls. and connection and tool	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 15:21
20	18	81/313.ccls. and connection and tool	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 15:22
21	1	81/376.ccls. and connection and tool	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 15:22
22	4	81/380.ccls. and connection and tool	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 15:22
-	0	compressing adj tool near cable and end adj connector	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 13:32
-	0	c mpressing adj t l near cable	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 13:32

-	0	compressing adj tool and body and handle and compress near member	USPAT; US-P PUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 13:33
-	31	compressing adj tool and body and handles	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 13:39
-	279	compressing adj tool	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/09/16 13:52
-	0	20020174538.URPN.	USPAT	2003/09/16 13:44

US-PAT-NO: D455325

DOCUMENT-IDENTIFIER: US D455325 S

TITLE: Compression tool

DATE-ISSUED: April 9, 2002

INVENTOR-INFORMATION:

NAME	CITY
STATE	ZIP CODE
COUNTRY	
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N/A	N/A
	CT

INT-CL: [07] 0805 (LOCARNO)

US-CL-ISSUED: D8/51, D8/51

US-CL-CURRENT: D8/51

FIELD-OF-SEARCH: D8/52; D8/32 ; D8/54 ; D8/55 ; D8/56 ;
D8/105 ; D8/107 ; 72/389 ; 72/409 ; 72/409.12 ; 81/342 ;
81/367 ; 81/370 ; 81/418 ; 81/420 ; 81/424.5 ; 81/427.5 ;
81/380 ; 81/390 ; 81/324 ; 81/486 ; 29/229 ; 29/268 ;
269/6 ; 269/86 ; 269/96

REF-CITED:

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43/4

N/A

N/A

ART-UNIT:

2911

PRIMARY-EXAMINER:

Douglas; Alan P.

ASSISTANT-EXAMINER:

Heflin; Clare E.



US005435167A

United States Patent [19]

Holliday et al.

[11] Patent Number: **5,435,167**[45] Date of Patent: **Jul. 25, 1995**[54] **CABLE END COMPRESSOR**[75] Inventors: **Randy Holliday, Westminster;**
Donald A. Kesinger, Morrison, both
of Colo.[73] Assignee: **CableReady, Inc., Denver, Colo.**[21] Appl. No.: **184,373**[22] Filed: **Jan. 21, 1994**[51] Int. Cl.⁶ **H01R 43/042**[52] U.S. Cl. **72/410; 29/751**[58] Field of Search **72/410, 409; 29/751;**
81/422, 424[56] **References Cited****U.S. PATENT DOCUMENTS**

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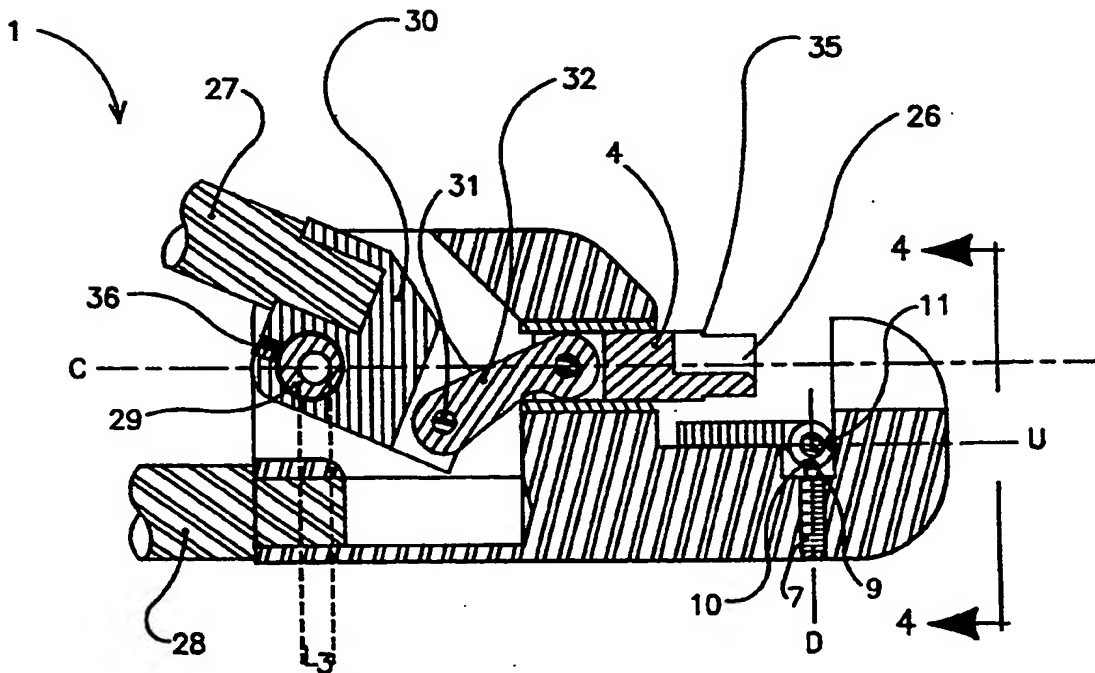
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Primary Examiner—Daniel C. Crane
Attorney, Agent, or Firm—Rick Martin

[57] **ABSTRACT**

A cable end compressor tool can handle RG59 and RG6 cable end assemblies. The fixed end of the tool acts as a brace. A plunger pushes a cable end assembly against the fixed end. A unique hinged spacer allows a single tool to switch from RG59 to RG6 cables instantly without any disassembly/re-assembly.

8 Claims, 4 Drawing Sheets

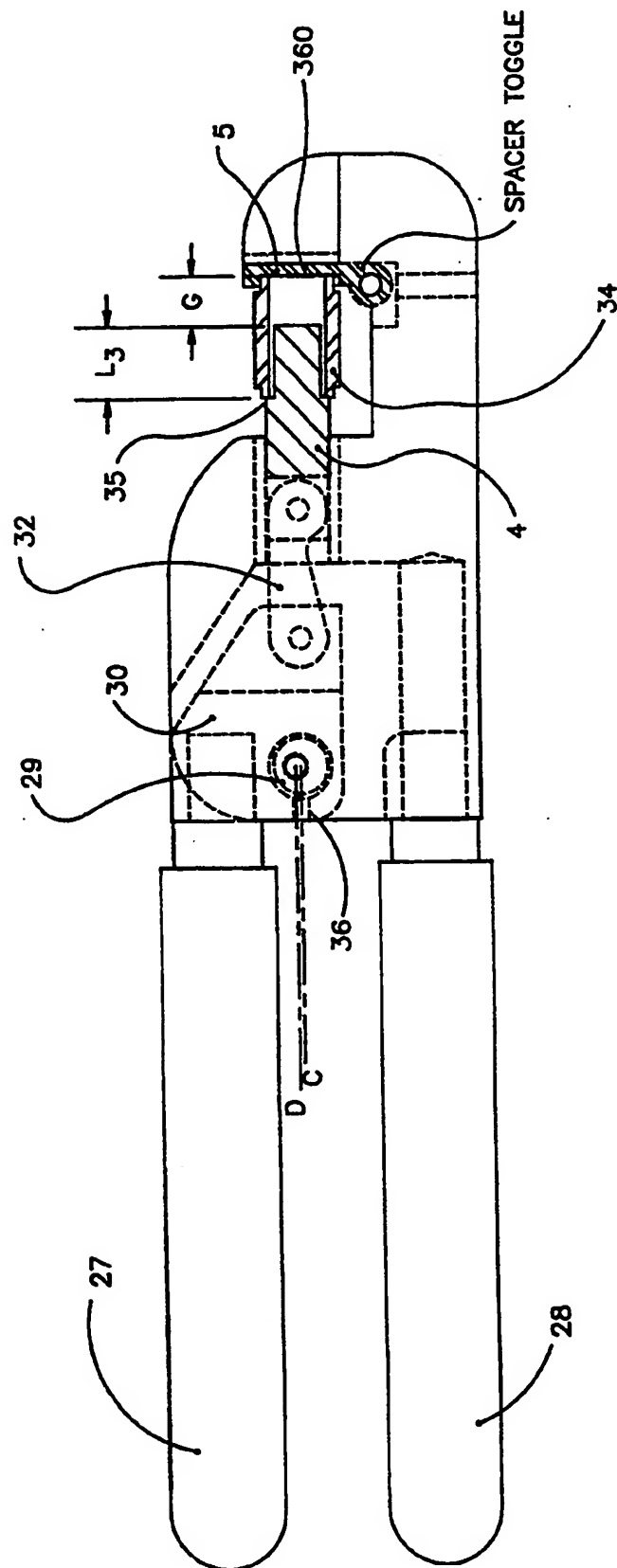


Fig. 5

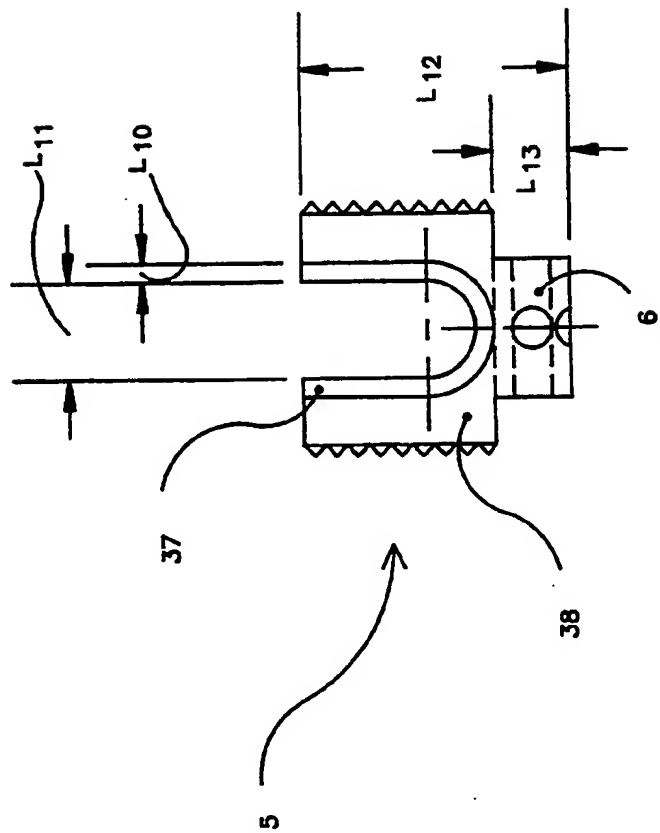


FIG. 6

CABLE END COMPRESSOR

CROSS REFERENCE PATENTS

U.S. Pat. No. 4,583,811 (1986) to McMills is incorporated herein by reference.

FIELD OF INVENTION

The present invention relates to crimping devices for coaxial cables.

BACKGROUND OF THE INVENTION

U.S. Pat. No. 4,583,811 (1986) to McMills is assigned to Raychem Corporation. Raychem sells the '811 coaxial cable assembly in both an RG59 and an RG6 embodiment. The RG59 has a female connecting collar that is generally 7/16" hexagonal width and 9/16" length. The cable OD is approximately 3/16". The RG6 embodiment has a female connecting collar that is generally 7/16" hexagonal width and 11/16" length. The cable OD is approximately 4/16".

The coaxial cables for the RG59 and RG6 connectors have a center conductor surrounded by a dielectric layer. The dielectric layer is surrounded with conductive shielding. The conductive shielding is surrounded by a protective outer jacket which environmentally seals the connection between an end coupling and the cable. It is critical for proper operation and maintainability of the coaxial cable that the connection between the end coupling and the cable be environmentally and electrically sealed.

The '811 patent teaches the use of a coupling assembly for attachment to the end of a length of coaxial cable. The assembly consists of the outer female connecting collar noted above. Inside the outer female connecting collar is an end coupling shaped like a cylinder having an open end for surrounding the cable, and a closed end having an opening for the cable dielectric and center conductor.

The preferred method for affixing a coupling assembly to a cable end is to use a cable end compressor tool. The function of the cable end compressor tool is to compress the cable end into the end coupling quickly with one squeeze of the tool handle.

The cable end compressor tool must have one fixed end to support the female connecting collar. A plunger is forced by the handle onto the partially closed end of the end coupling, thereby compressing the end coupling over a compressible member and against the cable end.

As noted above, the RG59 and RG6 cables have different length female connecting collars. Therefore, the distance from the fixed end of the tool to the plunger must be varied in accordance with the appropriate RG59, RG6 etc. female connecting collar in order to maintain the proper one handed squeezing grip on the tool's handle.

It is possible for a cable installer, therefore, to purchase two separate cable end compressor tools. One tool sized for the RG59, and one tool sized for the RG6 cable. This is an expensive solution.

Another solution is to use a Cablematic or compression tool. The Ripley Company of Cromwell, Conn. manufactures the Cablematic® device. The Ben Hughes Communicating Products Company of Chester, Conn. manufactures the Cable Prep device. These tools are suitable for compressing both RG59 and RG6 cable ends. However, a bolt must be loosened, and then an end plate rotated, and then the bolt re-tightened

when switching from the RG59 to the RG6 cable. These are time consuming steps. Furthermore, a special calibrating gauge is required to set the proper tolerances.

The present invention features a hinged spacer which can be flipped out of the way when compressing the larger RG6 cable. The hinged spacer can be flipped up against the fixed end of the compressor tool, thereby accommodating the shorter RG59 female connecting collar. Additionally, the RG6 connector body itself is used as the calibration device, thereby eliminating the need for a separate calibrating gauge.

In summary, the present invention solves the problem of providing a single cable end compressor tool capable of handling both RG59 and RG6 cables. The present invention converts quickly from RG59 to RG6 by utilizing a hinged spacer. The present invention eliminates the need for disassembly and re-assembly of a cable end compressor tool for handling various cables. The present invention also eliminates the need for a separate calibration device.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a single cable end compressor tool having a hinged spacer, thereby enabling compressing RG59, RG6 or other combinations of cable gauges.

Another object of the present invention is to use the RG6 connector body as the calibration device, thereby eliminating the need for a separate calibration gauge.

Other objects of this invention will appear from the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view of the working end of the present invention, a crimper, having an RG6 connector body on the plunger.

FIG. 2 is the same view as FIG. 1 showing the plunger compressing the mandrel of the connector body around a coaxial cable end.

FIG. 3 is a longitudinal sectional view of the crimper of FIGS. 1, 2.

FIG. 4 is a front (working end) plan view taken along line 4-4 of the crimper of FIG. 3.

FIG. 5 is a partial longitudinal sectional view of the crimper of FIGS. 1-4 in the calibration mode. FIG. 6.

FIG. 6 is a front plan view of the spacer 5 of FIGS. 1-5.

Before explaining the disclosed embodiment of the present invention in detail, it is to be understood that the invention is not limited in its application to the details of the particular arrangement shown, since the invention is capable of other embodiments. Also, the terminology used herein is for the purpose of description and not of limitation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIGS. 1, 2 a crimper 1 is shown before the crimping operation in FIG. 1 and after the crimping operation in FIG. 2. The crimper has a body 2 which supports a connector support end 3 and a plunger 4. A connector case 12 is an RG6 type with a length 1 of 9/16 inch. The plunger 4 supports the connector case

12 by insertion inside the hollow core 23 of the connector case 12. The hollow core 23 houses a sliding mandrel 14 which has a flat front end 24. The outside rear edge 18 of the mandrel 14 touches the thinnest neck of a frusto conical compression ring 16. An open space 15 exists between the outside rear edge 18 of the mandrel 14 and the compression ring 16. The outside of the compression ring 16 is fixedly engaged with the inside rear surface 17 of the connector case 12.

During the crimping operation an end of a coaxial cable is stripped to expose the cable central conductor 22, the cable dielectric 21, the cable braid 20, and the cable sheath 19 as shown in FIG. 2.

Then the outside rear edge 18 of the mandrel 14 and the compression ring are pressed against the exposed braid 20. Next the plunger 4 imposes upwards of 800 lbs on the flat front end 24 of the mandrel 14. This force compresses both the mandrel 14 and the compression ring 16 in a known manner around the cable sheath 19, thereby forming an effective EMI coupling. This process is substantially described in U.S. Pat. No. 4,583,811 (1986) to McMills which is incorporated herein by reference. The compressed mandrel is designated 140, and the compressed compression ring is designated 160.

The compressed mandrel 140 can slide inside the hollow core 23, thereby enabling the threads 25 to mate with a male connector (not shown).

The novelty of the present invention centers on the spacer 5 and the spacer hinge 6. The spacer hinge 6 has a spacer toggle having a down detent 10 and an up detent 11. The shot spring plunger 7 pushes the latch 9 into either the down detent 10 as shown (for handling an RG6 connector) or the up detent as shown in FIG. 5 (for handling an RG59 connector).

The width w of the spacer is equal to the difference in length between the RG6 connector (length=0.710 inch) and the RG59 connector (length=0.580 inch). Thus $w=0.130$ inch. In order to hold the spacer 5 in the down or up position without wobbling, the down detent 10 and up detent 11 are each about 0.010 inch off the central axes D, U respectively as shown in FIG. 3.

Raytheon® supplies the RG59 and RG6 connector case 12 and mandrel 14 assembly. Raytheon® specifies that the minimal distance, (G, FIG. 5) for the RG59 connector between the plunger 4 and the connector support end 3 is about 0.295 inch. The minimal distance for the RG6 connector is about 0.425 inch.

By referring to FIGS. 3,4,5 it is shown how the crimper 1 can crimp either the RG6 or RG59 connectors by merely flipping the spacer 5 to the down position (obtaining the minimal distance 0.395 inch) for the RG6 connectors, or flipping the spacer 5 to the up position (obtaining the minimal distance 0.265 inch) for the RG59 connector.

Furthermore, FIG. 5 shows the method for calibrating the crimper 1 in order to account for factory tolerances and/or wear and tear. It is understood that moving handle 27 is squeezed toward fixed handle 28 around pivot 29. Moving handle 27 down pivots block 30 upward, thereby lifting pivot 31 upward and forward until it reaches the longitudinal axis C of the pivot 29. As pivot 31 moves forward it pushes linkage 32 forward into plunger 4, thereby providing the working compression force of the crimper 1.

Referring next to FIG. 4 a front plan view of the crimper is shown as seen from line 4—4 of FIG. 3. The cable slot 33 enables the cable sheath 19, FIG. 2, to be placed in the working position. The conductor slot 26 of

the plunger 4 enables the cable central conductor 22 to slide inside plunger 4 during the crimping operation.

Referring next to FIG. 5 a unique calibration method is shown which does not require a separate gauge. The Raytheon® spec calls for the distance G (minimum plunger 4 distance from the connector support end 3) to be 0.295 inch for the RG59 connector. Wear and tear as well as factory tolerances can affect the lengths of the block 30, the linkage 32, the connector support end 3, and all related moving parts. In order to quickly and easily calibrate the distance G, the spacer 5 is flipped up and an RG6 connector case is placed on the plunger 4 backwards from the normal crimping position. The length 12 of the RG6 case 34 is known to be 0.710 inch. The length 13 from the ridge 35 to the tip 360 of the plunger 4, L₃, is known to be 0.415 inch. Therefore, with the handle 27 squeezed down the distance G is known to be 0.295 inch. It should be noted that pivot 29 is eccentric in that its longitudinal axis D is 0.030 inch off axis to axis C. In this manner the set screw 36 can be loosened and the pivot 29 turned to adjust the forward throw of the pivot 29 by ± 0.030 inch. For calibration of distance G, the plunger 4 is moved forward by handle 27 until the ridge 35 contacts the RG6 case 34. Then the set screw 36 is loosened. Then the pivot 29 which is eccentric is rotated so that the handles 27, 28 are parallel at the full forward stroke of the plunger 4. Finally the set screw 36 is tightened.

Referring last to FIG. 6 the spacer 5 is shown to have a spacer face 38. An optional connector detent 37 is shown to help align a connector (not shown). Nominal dimensions are:

- L₃=0.415 inch
- L₁₀=0.060 inch
- L₁₁=0.315 inch
- L₁₂=0.875 inch
- L₁₃=0.250 inch

KEY

1. crimper
2. body
3. connector support end
4. plunger
5. spacer
6. hinge
7. shot spring plunger
8. spacer toggle
9. latch
10. down detent
11. up detent
12. connector case
13. back end of connector case
14. mandrel
15. open space
16. compression ring
17. inside rear surface of connector case
18. outside rear edge of mandrel
19. cable sheath
20. cable braid
21. cable dielectric
22. cable central conductor
23. hollow core
24. flat front end of mandrel
25. threads
26. conductor slot
27. moving handle
28. fixed handle
29. pivot

- 30. block
- 31. pivot
- 32. linkage
- 33. cable slot
- 34. RG6 case
- 35. ridge
- 36. set screw
- 37. connector detent
- 38. spacer face
- 140. compressed mandrel
- 160. compressed compression ring

Although the present invention has been described with reference to preferred embodiments, numerous modifications and variations can be made and still the result will come within the scope of the invention. No limitation with respect to the specific embodiments disclosed herein is intended or should be inferred.

I claim:

1. A cable end crimping tool comprising:

a body;

a fixed end for supporting a first connector case with a first mandrel, coaxial cable end and compression ring located inside the first connector case;

a plunger reciprocatingly mounted axially opposing the fixed end;

force means to reciprocate the plunger to a minimum distance from the fixed end, thereby urging the first mandrel inside the first connector case a distance

L3 toward a back end of the first connector case thereby forming an EMI connection by deforming the compression ring around the coaxial cable end;

a spacer adjacent the fixed end, functioning to allow the plunger to urge a second mandrel inside a shorter second connector case the same distance L3 when the spacer is positioned against the fixed end; and

said spacer further comprising positioning means functioning to move the spacer out of service, thereby not affecting the minimum distance, whereby the first and second connector cases of

different lengths can be interchangeably mounted between the fixed end and the plunger by moving the spacer in and out of service by the positioning means.

2. The tool of claim 1 wherein said force means further comprise opposing handles.

3. The tool of claim 1 wherein said positioning means further comprises a hinge.

4. The tool of claim 3 wherein said hinge further comprises an up in service and a down out of service position.

5. The tool of claim 4 wherein said hinge further comprises off center detents, functioning to secure the hinge in position.

6. The tool of claim 2 wherein one handle member further comprises an eccentric pivot, functioning to provide a means of calibration to set the minimum distance minus a spacer thickness as the distance from a ridge on the plunger, when the ridge urges the second connector case against the spacer, to the spacer.

7. A cable end crimping tool for compressing a mandrel around a compression ring against a coaxial cable end inside a connector case comprising:

a body having a connector support end on a first handle, a second handle having a linkage to a reciprocating plunger for reciprocating the plunger towards and away from the connector support end; a spacer having positioning means on the connector support end to vary two minimum distances between the connector support end and the reciprocating plunger;

said positioning means further comprising a hinge to permit varying the two minimum distances; and said minimum distances further comprising a length of an RG59 and an RG6 connector.

8. The tool of claim 6, wherein the first connector case is a Raytheon® RG6 and the second connector is a Raytheon® RG59.

* * * * *

United States Patent [19]

Sato

[11] Patent Number: **4,790,068**

[45] Date of Patent: **Dec. 13, 1988**

[54] TERMINATION TOOL

[75] Inventor: **Kensaku Sato, Tokyo, Japan**

[73] Assignee: **Hirose Electric Co., Ltd., Tokyo, Japan**

[21] Appl. No.: **128,902**

[22] Filed: **Dec. 4, 1987**

[30] Foreign Application Priority Data

→ Dec. 5, 1986 [JP] Japan 61-288970

[51] Int. Cl.⁴ **B23P 19/04; B21D 7/06**

[52] U.S. Cl. **29/761; 72/410; 72/412; 72/461; 72/477; 81/422; 29/751**

[58] Field of Search **72/410, 409; 416, 477, 72/472, 442, 447, 461, 412; 29/751, 748, 761; 81/422, 423**

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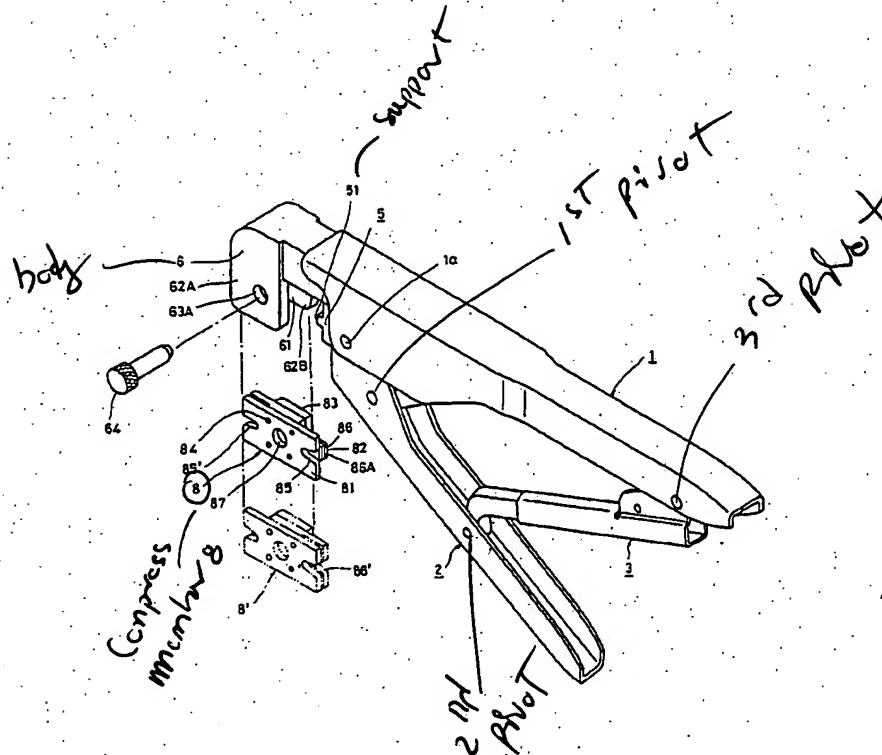
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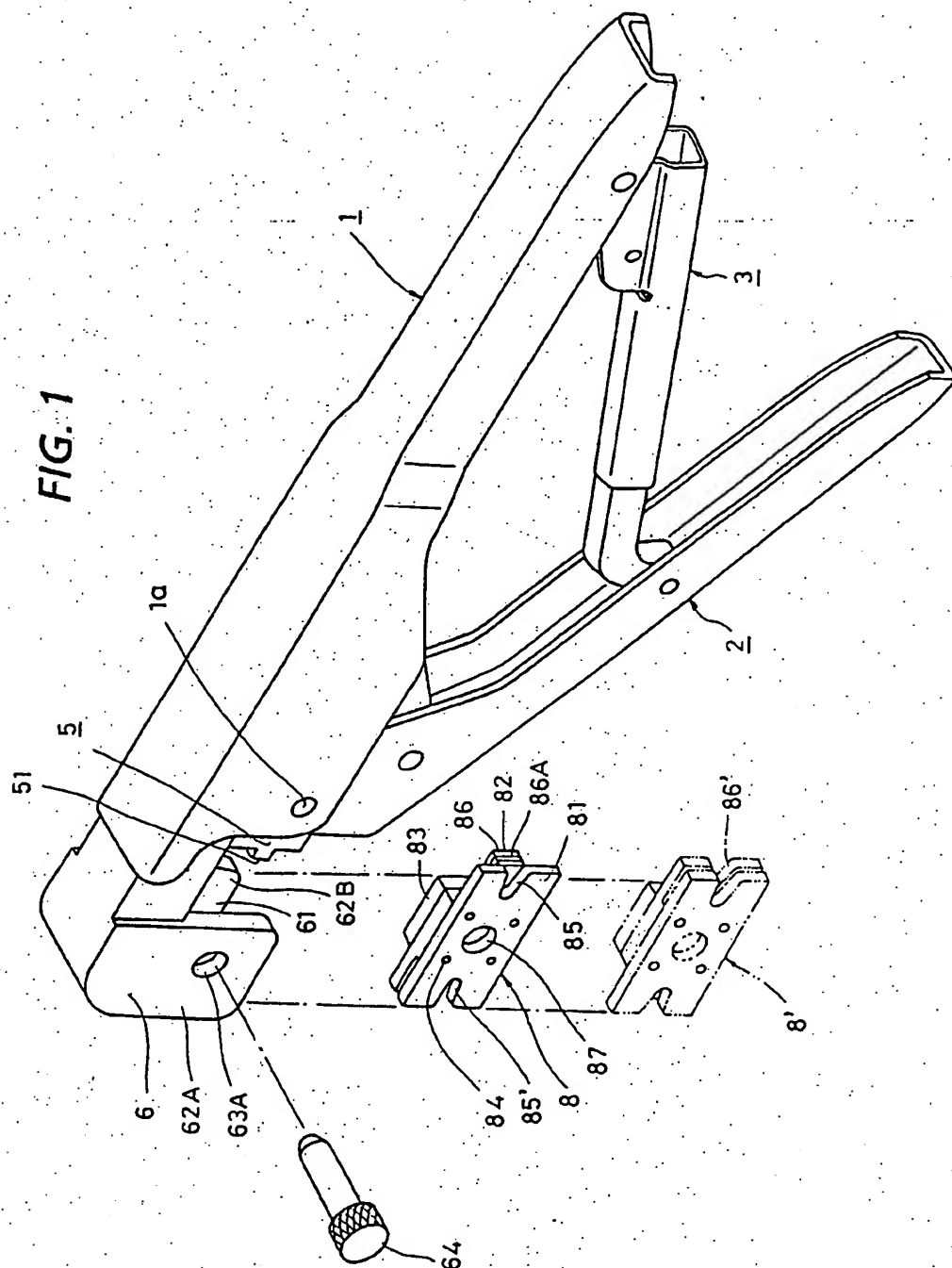
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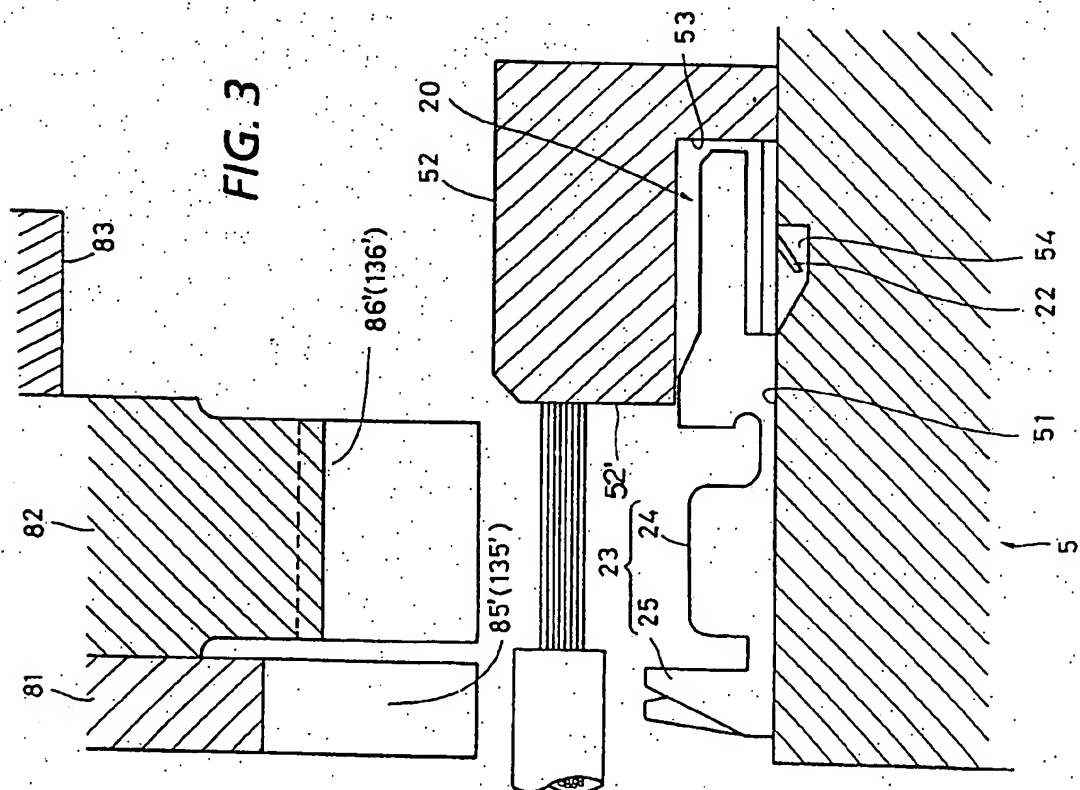
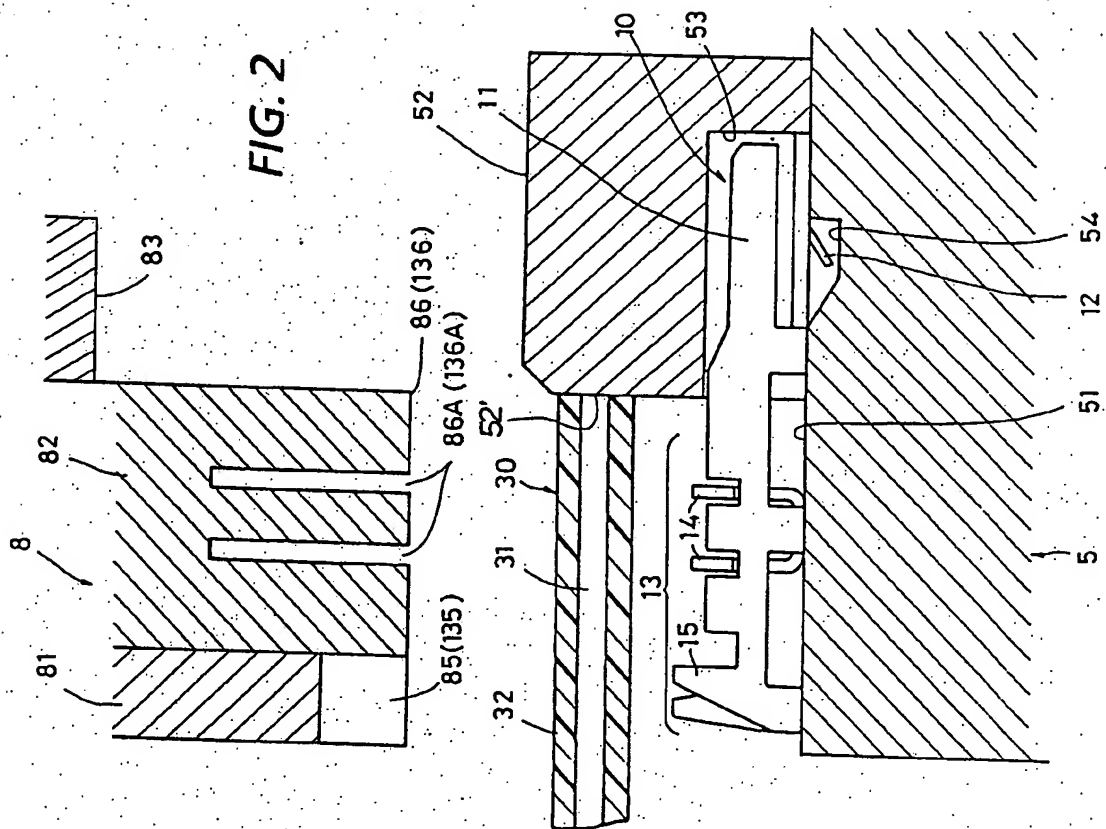
[57] ABSTRACT

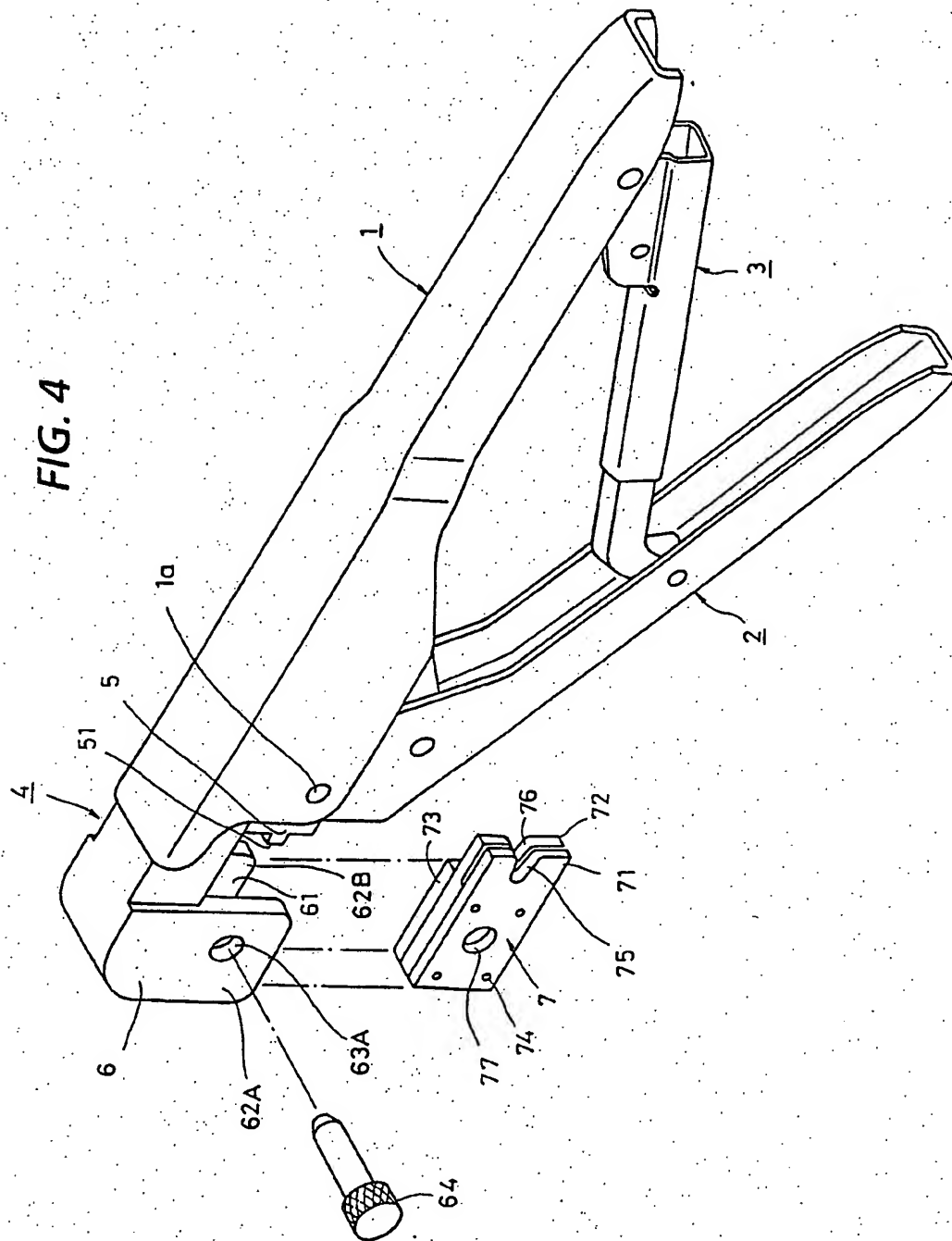
A termination tool for terminating a conductor to a contact or terminal having a connecting section for connection with the conductor and a contacting section for contact with a mating contact. The connecting section has either piercing walls or clamp tabs and strain relief tabs. The termination tool consists of a fixed base or head for supporting the contact and a movable die movable toward the fixed base to terminate the contact by either piercing or crimping.

2 Claims, 3 Drawing Sheets









TERMINATION TOOL

BACKGROUND OF THE INVENTION

The present invention relates to termination tools for terminating by crimping or piercing a conductor to a connector contact or terminal.

FIG. 4 shows a conventional manual crimping termination tool in the art. It consists of a fixed grip 1 and a movable grip 2 pivoted to the fixed grip with a pin 1a. The fixed grip 1 has at the front end a fixed base 5 and a receiving recess into which the contacting section of a crimping type contact or terminal is inserted in such a manner that the back of the contact may rest on the support 51.

The movable grip 2 has at the front end a movable head 6 which moves toward or away from the fixed base 5 when the movable grip 2 is squeezed or released. The movable head 6 has a pair of side walls 62A and 62B which define an opening 61 in which a crimping die 7 is able to mount with a shaft screw 64.

The movable die 7 consists of a sheath crimping plate 71, a wire crimping plate 72, and a reinforcing plate 73, which are brought together with a plurality of knock pins 74. The reinforcing plate 73 serves also as a stopper for putting a certain limit on the amount of crimping. The sheath or wire crimping plate 71 or 72 has a U-shaped recess 75 or 76 for crimping the sheath or wire clamp tabs of a contact.

In operation, when both the grips 1 and 2 are squeezed after a crimping type contact is inserted into the receiving recess of the fixed head 5 and an exposed wire is placed on the connecting section of the contact, the movable head 6 is advanced toward the fixed head 5 for termination by crimping with the crimping die 7.

The above crimping tool is useful for terminating crimping type contacts but useless for piercing type contacts which are also widely used, thus requiring separate piercing termination tools, too, resulting in the increased facility costs.

SUMMARY OF THE INVENTION

According to the invention there is provided a termination tool for terminating a conductor to a contact or terminal which has a connecting section for connection with the conductor and a contacting section for connection with a mating contact, the connecting section having either piercing walls or clamp tabs and strain relief tabs, characterized by a fixed base for supporting the contact; and a movable die movable toward the fixed base to terminate the contact by either piercing or crimping.

The piercing and crimping dies of this termination tool are very easy to exchange to meet user's need to terminate contacts of both piercing and crimping types.

Other objects, features, and advantages of the invention will be apparent from the following description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of a termination tool according to the invention;

FIGS. 2 and 3 are sectional views of the head portion of the termination tool for termination by piercing and by crimping, respectively; and

FIG. 4 is an exploded perspective view of a termination tool according to the prior art.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1, there is shown a manual termination tool, with its essential parts exploded, which is almost identical with the afore-mentioned conventional manual crimping tool except for a movable die 8.

Like the conventional one, the movable die 8 consists of a sheath crimping plate 81, a wire crimping plate 82, and a reinforcing plate 83, which are brought together with a plurality of knock pins 84. Alternatively, they may be brought together with welding, adhesive, or screws. This movable die 8 is made useful for both piercing and crimping operations.

The sheath crimping plate 81 has at one end a U-shaped recess 85 for crimping strain relief tabs 15 of a piercing type contact 10 (FIG. 2) and on the other end a U-shaped recess 85' for crimping strain relief tabs 25 of a crimping type contact 20 (FIG. 3). The wire crimping plate 82 has on the same side as the U-shaped recess 85 a flat portion 86 for termination by piercing of a conductor to the piercing type contact 10. As best shown in FIG. 2, the flat portion 86 has a pair of receiving slots 86A for receiving a pair of piercing walls 14 of a piercing section 13. As best shown in FIG. 3, the wire crimping plate 82 has on the opposite side or the same side as the U-shaped recess 85' a U-shaped cross-section channel 86' for crimping clamp tabs 24 to secure the wires of a conductor. The crimping channel 86' has on the bottom a ridge with a top of an acute angle for bending around free ends of the clamp tabs 24. The reinforcing plate 83 is substantially identical with the conventional one.

The movable die 8 has at the center an aperture 87 for receiving a shaft 64. By removing the shaft 64 the movable die 8 may be turned around by 180 degrees so that the termination tool may be used to terminate both piercing and crimping type contacts.

Piercing Type Contact

(1) The movable die 8 is mounted in the opening 61 of the movable head 6 with the shaft screw 64 in such a manner that the flat portion 86 may face toward the contact support 51.

(2) A piercing type contact 10 is inserted into the receiving recess 53 so that the back of the contact may rest on the support 51. As best shown in FIG. 2, the contacting section 11 of the contact 10 is inserted into the receiving recess 53 formed in the support section 52, with the latch tab 12 received in the recess 54 provided on the bottom of the receiving recess 53.

(3) A conductor 30 is placed over the connecting section 13 of the contact 10 without removing the sheath 32 so that the front end of a wire 31 abuts an abutment face 52' of the support section 52 for accurate positioning of the conductor 30.

(4) The fixed and movable grips 1 and 2 are squeezed to connect by piercing the conductor 30 to the connecting section 13 of the contact 10. More specifically, the conductor 30 is pushed into the slits of the piercing walls 14 so that the wire 31 may come into contact with the piercing walls while the strain relief tabs 15 are crimped on the sheath 32 to secure the conductor 30.

(5) The fixed and movable grips 1 and 2 are released to the original positions, respectively, and the terminated contact is now removable from the base 5.

Crimping Type Contact

(1) After the shaft 64 is removed, the movable die 8 is turned around by 180 degrees and fixed with the shaft screw 64 so that the crimping recess 86' face the fixed base 5 as shown with a two-dot chain line in FIG. 1.

(2) As FIG. 3 shows, a conductor, with lengths of wires exposed for termination, is placed over the a crimping type contact 20 so that the front ends of the wires abut the abutment face 52' of the support section 10 52 for accurate positioning of the conductor.

(3) The fixed and movable grips 1 and 2 are squeezed so that the clamp tabs 24 are crimped around the wires by the crimping channel 86'. Like the above piercing contact, the strain relief tabs 25 are crimped on the 15 sheath to secure the conductor.

Alternatively, the movable grip 2 may be moved pneumatically or hydraulically. The movable die 8 may be made so that it is able to turn by loosening the shaft screw without removing it completely. Two separate 20 piercing and crimping dies may also be used.

The termination tool of the invention enables one to terminate both piercing and crimping type contacts with a single tool, thus reducing the facility costs. Since it is so easy to change the piercing die to the crimping 25 die, or vice versa, the efficiency of work requiring both piercing and crimping operations in the same job is improved very much. Since the insulation piercing and crimping dies are made integral and always mounted on the tool for ready to use so that there is no need for 30 storage of separate insulation piercing and crimping dies. In the support section, there is provided a receiving recess which surrounds the contact section of a contact during the cable termination operation so that the contact section is protected against deformation 35 caused by collision with another object during the operation. There is also provided an abutment face against which the front end of a wire is abutted so that the conductor is connected to the connection section of a contact with high accuracy.

While a preferred embodiment of the invention has been described using specific terms, it is to be under-

stood that changes and variations may be made without departing from the spirit and scope of the invention as recited in the the spirit and scope of the invention as recited in the appended claims.

I claim:

1. A termination tool capable of terminating a conductor to either piercing type contact with a pair of piercing walls or crimping type contact with a pair of clamp tabs, which comprises:

a fixed base for supporting either said piercing or crimping type contact, said fixed base including a contact support surface on which a connection section of said piercing or crimping type contact is placed, a receiving recess extending laterally from said contact support surface such that it surrounds a contact section of said piercing or crimping type contact, and an abutment face lying in a plane perpendicular to said contact support surface, against which a front end of said conductor is abutted for accurate positioning of said conductor;

a movable die having a piercing end adapted to terminate said conductor to said piercing type contact and a crimping end adapted to terminate said conductor to said crimping type contact, said piercing end having means to push said conductor into a piercing type contact so that insulation on said conductor is pierced by piercing walls on said piercing type contact and said crimping end having only means to deform tabs on said crimping type contact around a conductor seated in said crimping type contact; and

means connecting said movable die to said tool for allowing selection of either said piercing or crimping end to be used for terminating operation according to said piercing or crimping type contact to be terminated.

2. The termination tool of claim 1, wherein said movable die is made integral and able to take a first position where said movable die is useful as a piercing die and a second position where said movable die is useful as a crimping die.

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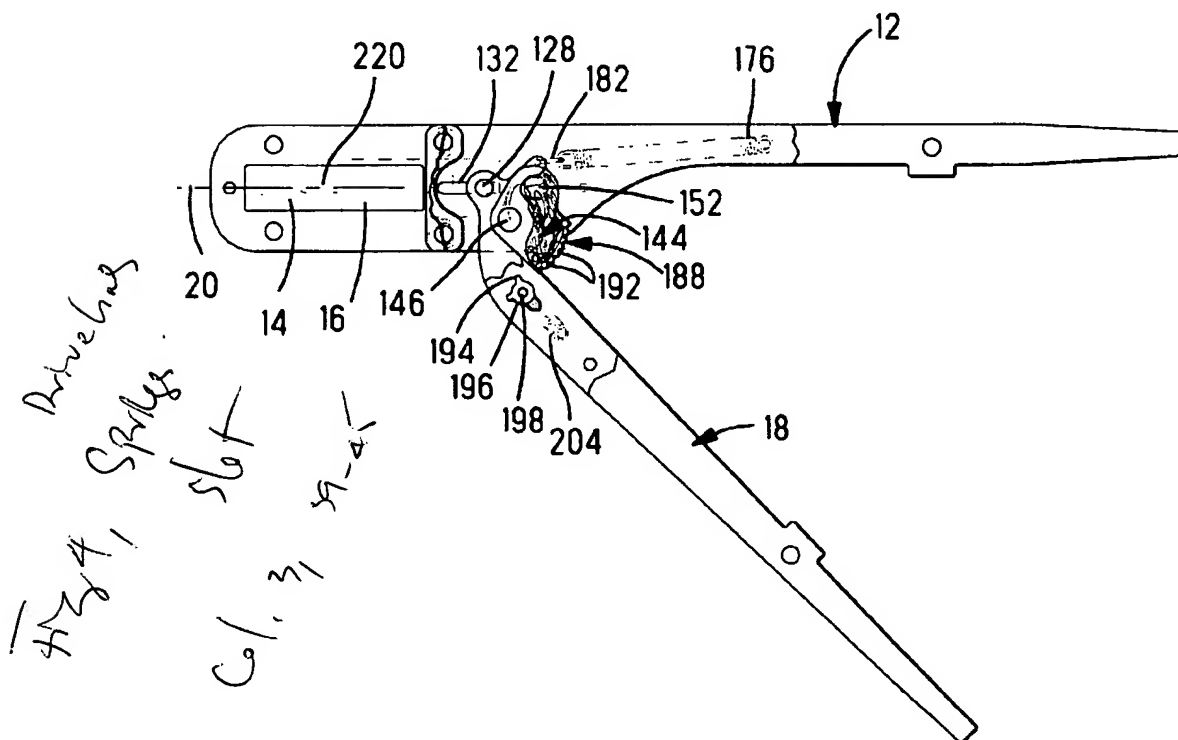
United States Patent [19][11] **Patent Number:** 5,870,925**Morris et al.**[45] **Date of Patent:** Feb. 16, 1999[54] **HAND TOOL CRIMPING A TERMINAL
ONTO A CONDUCTOR**[75] **Inventors:** Michael Morris, Harrisburg; Richard
Lloyd Schaeffer, Carlisle, both of Pa.[73] **Assignee:** The Whitaker Corporation,
Wilmington, Del.[21] **Appl. No.:** 883,771[22] **Filed:** Jun. 27, 1997[51] **Int. Cl.⁶** H01R 43/042[52] **U.S. Cl.** 72/409.12; 29/751; 81/313;
81/363[58] **Field of Search** 72/409.12, 409.14,
72/409.01, 456, 453.16; 81/313, 355, 362,
363; 29/751[56] **References Cited****U.S. PATENT DOCUMENTS**

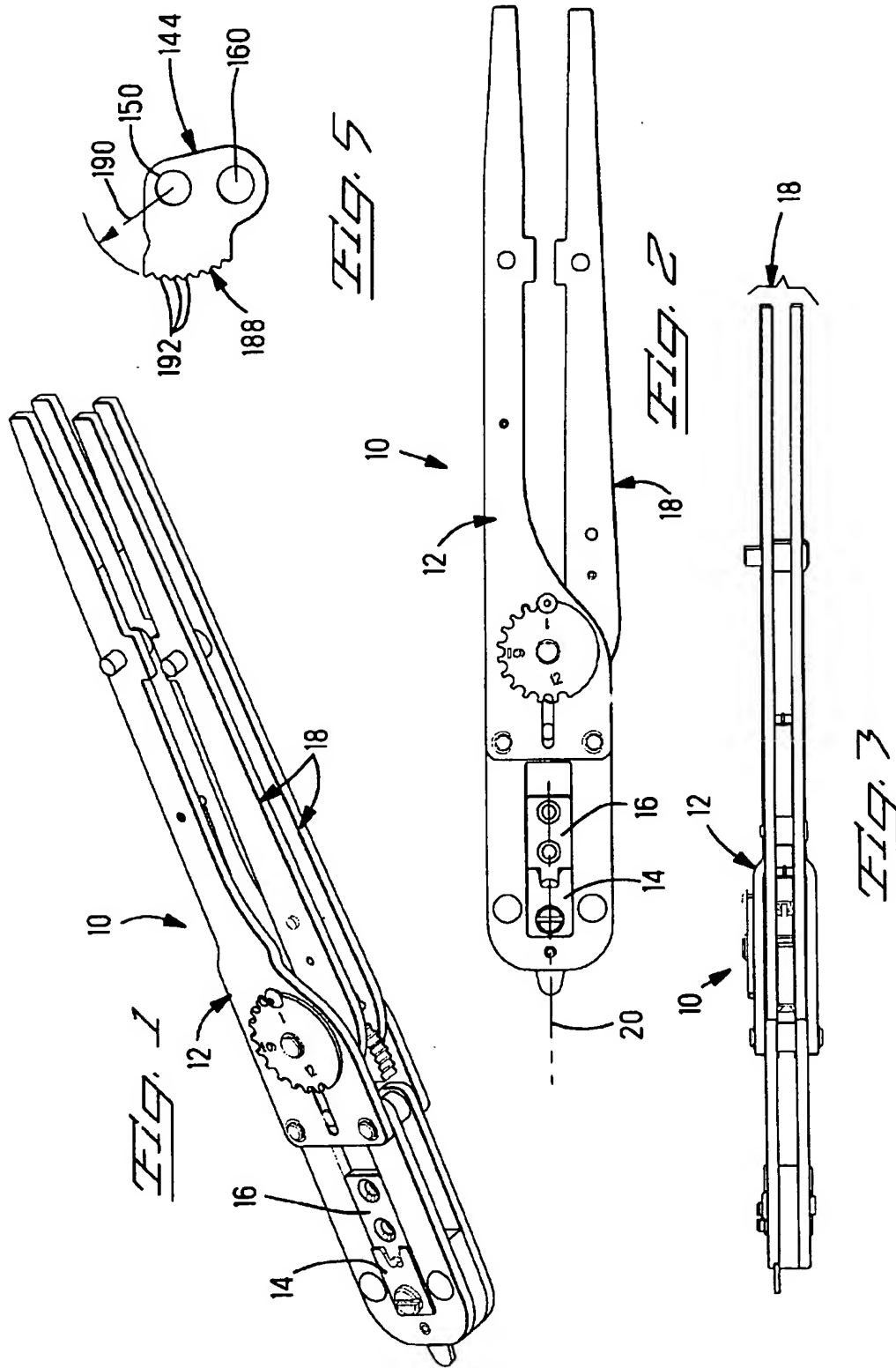
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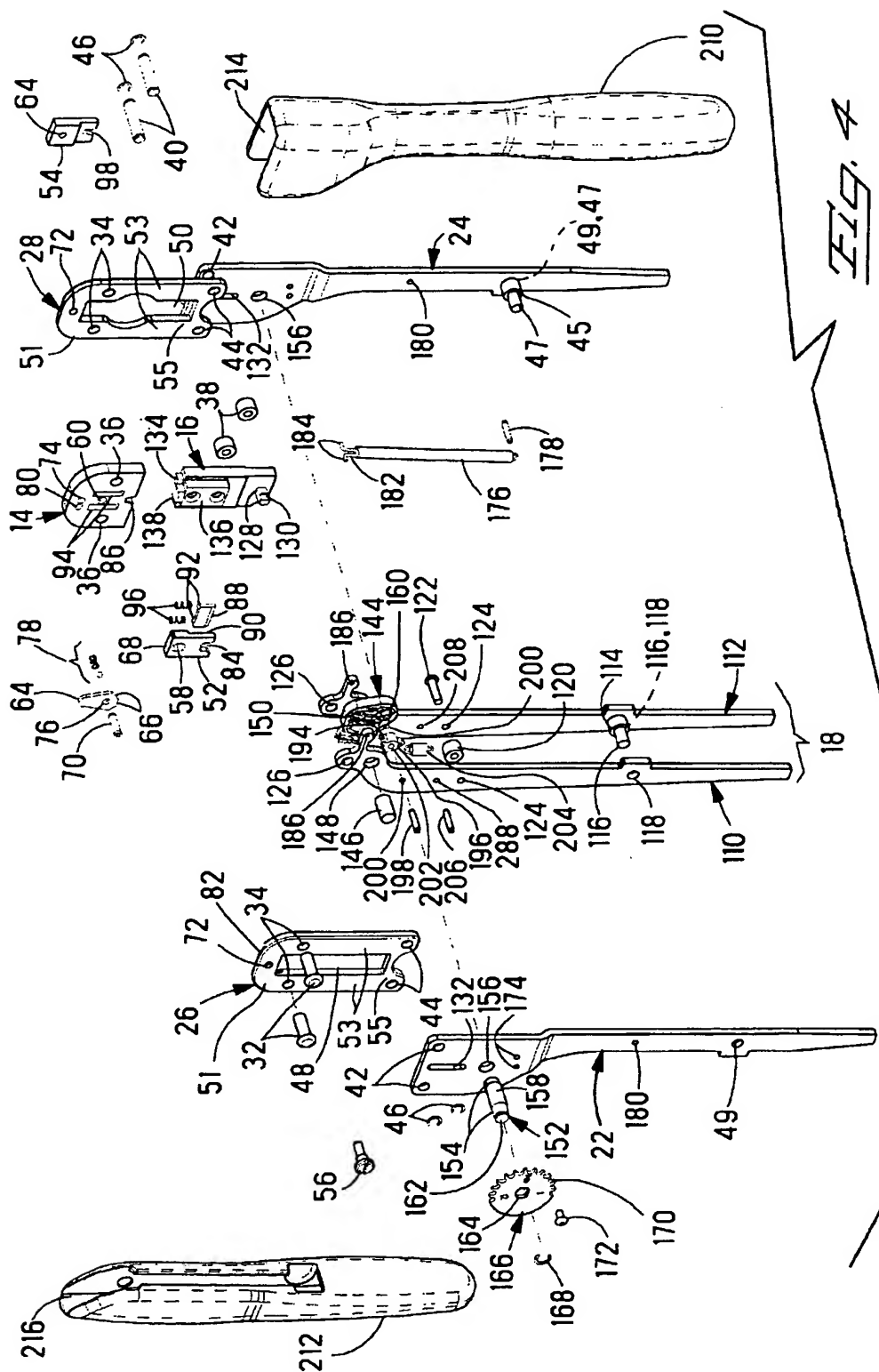
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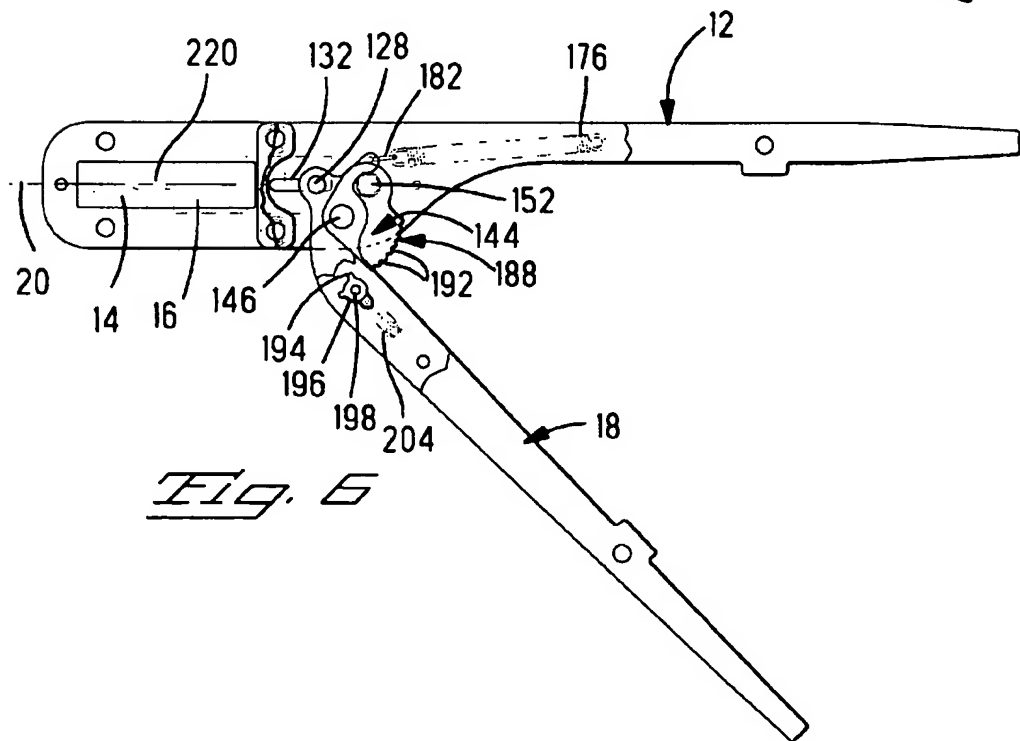
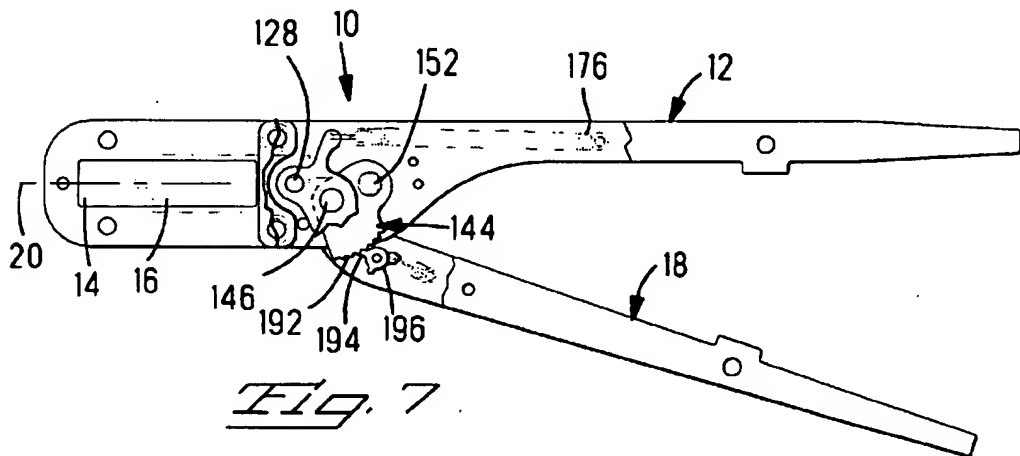
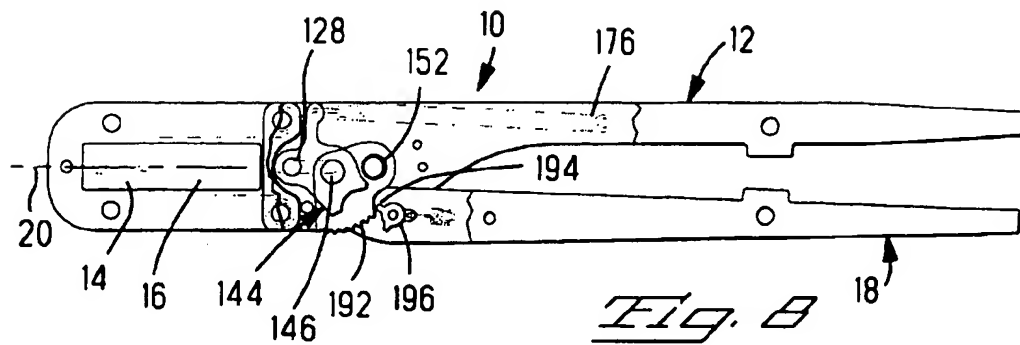
Primary Examiner—Daniel C. Crane**Attorney, Agent, or Firm**—Mary K. VanAtten[57] **ABSTRACT**

A hand tool (10) is provided for crimping an electrical terminal onto a conductor. The tool includes a frame (12) having a fixed crimping tool (14) secured at one end and a movable crimping tool (16) arranged to slide along a linear path (20) within a guideway (48) in the frame (12) toward and away from the fixed crimping tool (14). A lever (18) is pivotally coupled to the movable crimping die (16) by a drive link (144) and three pivotal attachments (128, 146, 152). The drive link (144) includes a ratchet surface (188) in engagement with a pawl (196) pivotally attached to the lever (18) for compelling continued movement of the lever once a crimping operation has begun.

8 Claims, 3 Drawing Sheets







HAND TOOL CRIMPING A TERMINAL ONTO A CONDUCTOR

The present invention relates to a hand tool for crimping electrical terminal onto a conductor and more particularly to such a hand tool having a toggle action and linear movement of the crimping tooling.

BACKGROUND OF THE INVENTION

Hand operated crimping tools for crimping a terminal onto a conductor generally include a frame, a pair of pliers-like handles, and a mechanical linkage. A pair of mating crimping dies is included, one die being coupled to each handle so that upon operation of the handles the two dies are brought into mating engagement for effecting the desired crimped termination. Such a hand tool is disclosed in U.S. Pat. No. 4,829,805 which issued May 16, 1989 to Koehn. In some variations of this structure one of the handles is fixed to the frame so that, upon operation of the handles, only the die coupled to the other handle is pivoted into engagement with the die coupled to the frame. Such hand tools are disclosed in U.S. Pat. Nos. 5,307,553 which issued May 3, 1994 to Frohlich; 5,168,743 which issued Dec. 8, 1992 to Schrader et al.; 5,012,666 which issued May 7, 1991 to Chen et al.; and 4,614,107 which issued Sep. 30, 1986 to Norin. Typically, the mechanical linkage of these tools utilizes a drive link pivotally attached to the frame and the movable handle, with the handle being pivotally attached to a pivoting jaw which carries the movable die into engagement with a fixed die attached to the frame. A serrated surface on a side of the drive link engages a pawl pivotally attached to the movable handle for compelling full movement of the handle once the crimping operation is started. This linkage structure has the advantage of being simple to manufacture and maintain and is very effective and efficient to operate. However, such hand tools are limited to pivotal movement of the two mating dies during the crimping operation. This pivotal movement causes a slight rolling of the terminal as the mating dies crimp the terminal barrel causing distortion of the final crimped termination profile. Linear movement of the two mating dies is more desirable because this rolling action is not present. However, hand tools that utilize mechanisms that support linear movement of the mating crimping dies usually incorporate a C-shaped frame structure that is required to be relatively massive to prevent deflection during the crimping operation. See, for example, U.S. Pat. Nos. 3,322,008 which issued May 30, 1967 to Filia and 5,042,286 which issued Aug. 27, 1991 to Wiebe et al. Necessarily these structures utilize a linkage structure that is different, and frequently more complex, than the more desirable linkage structure of the pivoting hand tools mentioned above.

What is needed is a crimping hand tool that utilizes the toggle type actuating mechanism of the pivoting tools but moves the mating dies together along a linear path during the crimping operation, while providing a frame that is relatively small and light weight but sufficiently strong to prevent significant deflection during the crimping operation.

SUMMARY OF THE INVENTION

A tool is disclosed for crimping an electrical component onto a conductor to form a crimped connection. The tool includes a frame having a guideway, a fixed crimping tool secured to the frame, and a movable crimping tool arranged to slide along a linear path within the guideway in the frame in a first direction toward the fixed crimping tool and in a

second opposite direction. A link is provided having a first end pivotally attached to the frame and a second end spaced therefrom. A handle having a free end includes an end opposite the free end that is pivotally attached to the movable crimping tool, and another end pivotally attached to the second end of the link at a point between the free end and the end opposite thereof. When the free end of the handle is moved toward the frame through a specific distance the movable crimping tool is moved in the first direction thereby effecting the crimping of the terminal. When the free end of the handle is moved away from the frame the movable crimping tool is moved in the second direction. A series of teeth is arranged to form a ratchet surface on the link. A pawl is pivotally attached to the handle and is arranged to engage the teeth of the ratchet surface upon movement of the free end toward the frame and, once so engaged, to compel the movement of the free end through the specific distance.

DESCRIPTION OF THE FIGURES

FIG. 1 is an isometric view of a crimping tool incorporating the teachings of the present invention;

FIGS. 2 and 3 are plan and side views, respectively, of the tool shown in FIG. 1;

FIG. 4 is an exploded parts view of the tool shown in FIG. 1;

FIG. 5 is a plan view of the drive link shown in FIG. 4; and

FIGS. 6, 7, and 8 are partial cutaway views of the tool shown in FIG. 2, showing the actuating mechanism of the tool in different operating positions.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There is shown in FIGS. 1, 2, 3, and 4, a hand operated tool 10 for crimping a terminal onto a conductor. The tool 10 includes a frame 12, a fixed crimping die 14, a movable crimping die 16 that mates with the fixed die, and a lever 18 that is coupled to the frame and arranged to move the movable die along a linear path 20 toward and into crimping engagement with the fixed die. As best seen in FIG. 4, the frame 12 consists of left and right elongated members 22 and 24, respectively, and left and right head plates 26 and 28, respectively, which are secured together to form a single rigid unit, as will be explained. The fixed crimping die 14 is sandwiched between the left and right head plates 26 and 28 and the assembly secured together by means of two rivets 32 that extend through holes 34 formed through the two head plates and holes 36 formed through the fixed crimping die. The left and right head plates 26 and 28 are secured to the left and right elongated members 22 and 24 by means of two pins 40 which extend through two slip fit holes 42 formed through each of the elongated members and two slip fit holes 44 formed through each of the head plates. A pair of spacers 38 having a thickness similar to the thickness of the fixed crimping die 14 are disposed between the left and right head plates 26 and 28 so that the pins 40 extend therethrough. The two pins 40 are retained in place by means of spring retaining rings 46 that engage grooves formed in the ends of the pins 40 in the usual manner. A spacer 45 having a reduced diameter 47 on each end is arranged between the left and right elongated members 22 and 24 with the reduced diameters extending through holes 49 formed through the lower portions of the elongated members. The ends of the reduced diameters that extend past the elongated members are peened over to form a rigid attachment. The two rivets

32, two pins 40, and the peened spacer 45 combine to secure the left and right head plates and the left and right elongated members together into a rigid frame structure. The left head plate 26 includes an elongated opening 48 while the right head plate 28 includes a somewhat modified elongated opening 50, both of which have longitudinal axes that coincide with the linear path 20, as viewed in FIG. 2. The opening of each head plate defines a top portion 51, two side portions 53 and a bottom portion 55 that form a rigid structure. An insulation crimping die 52 is disposed within the upper portion of the opening 48 against the surface of the fixed die 14 and a similarly shaped terminal straightener 54 is disposed within the opening 50 against the opposite face of the fixed die, as shown in FIG. 4. A screw 56 extends through an elongated hole 58 formed through the die 52, a hole 60 formed through the fixed die 14, and into a threaded hole 64 in the terminal straightener 54. The elongated hole 58 permits a small amount of movement of the insulation crimping die 52 along the linear path 20 for adjustment purposes. Such adjustment is made by a lever 65 having several flat surfaces 66, each of which can engage a top surface 68 of the insulation crimping die 52 by pivoting the lever. The lever 65 is pivoted about a spring pin 70 which extends through holes 72 formed through the left and right head plates 26 and 28, a hole 74 formed through the fixed crimping die 14, and a hole 76 formed through the lever so that it is a different distance from each of the flat surfaces 66. The insulation crimp height of the tool is adjusted by pivoting the lever 64 so that a desired flat surface 66 is in engagement with the surface 68. A ball and spring assembly 78 extending from a hole 80 in the fixed crimping die 14, serves as a detent by engaging dimples, not shown, in the lever 65 thereby holding the lever in the selected position. A recess 82 is formed in the inwardly facing surface of the left head plate 26 to provide clearance for the lever 65. An insulation crimping die form 84 is formed in the downwardly facing end of the insulation crimping die 52 and a terminal crimping die form 86 is formed in the downwardly facing end of the fixed crimping die 14. A terminal locating member 88 is disposed within a cutout 90 of the insulation crimping die 52 and arranged to slide vertically between the die 52 and the adjacent wall of the fixed crimping die 14. A pair of tabs 92 extend from the member 88 into vertically disposed slots 94 formed in the fixed crimping die 14. A pair of springs 96 are arranged within the slots 94 to urge the locating member 88 downwardly into locating engagement with the terminal, in the usual manner. The terminal straightener 54 includes a locating form 98 that engages the terminal being crimped and holds it in position during the crimping operation.

The lever 18, as best seen in FIG. 4, is composed of left and right lever members 110 and 112, respectively, that are attached together by means of a spacer 114 having a reduced diameter 116 on each end. The reduced diameters extend through holes 118 formed through each lever member and are peened over to form a rigid attachment. Another spacer 120 is disposed near the upper end of and between the left and right lever members 110 and 112. A rivet 122 extends through holes 124 formed through the lever members and through the spacer 120 and is peened over in the usual manner. The rivet 122 and the spacer 114 secure the left and right lever members together to form a rigid lever 18. A hole 126 is formed through the upper most end of each of the left and right lever members 110 and 112 and are slip fits for a pin 128 that is pressed in a hole in and extends from opposite sides of the movable crimping die 16. The movable crimping die 16 is disposed between the left and right lever members

and is pivotally coupled thereto by means of the pin 128. Each end of the pin 128 has a pair of parallel flats 130 that are slidably received within a vertically disposed elongated hole 132 formed in the upper most ends of the left and right elongated members 22 and 24. The movable crimping die 16 has a crimping die form 134 in its upper surface that is in alignment and mates with the die form 86. A lower insulation crimping die 136 is rigidly attached to and carried by the movable crimping die 16 by any suitable means, and includes an insulation crimping die form 138 that is in alignment and mates with the die form 84 of the insulation crimping die 52. The width of the lower insulation crimping die 136 is chosen to be a sliding fit within the opening 48, which serves as a guideway, without appreciable side to side play so that the movable crimping die 16 and attached insulation crimping die 136 are free to slide along the linear path 20, shown in FIG. 2. A drive link 144 is disposed between the upper ends of the left and right lever members 110 and 112 and is pivotally attached thereto by means of a pin 146 that extends through a hole 148 formed through each of the left and right lever members and a hole 150 formed through the drive link. The drive link 144 is itself pivotally coupled to the left and right elongated members 22 and 24 by means of a pin 152. The pin 152 includes two in-line diameters 154 which are in slip fit engagement with holes 156 formed through the left and right elongated members, and an eccentric diameter 158 that is in slip fit engagement with a hole 160 formed through the drive link 144, as shown in FIG. 4. The left most end of the pin 152 includes a flat 162 formed thereon that is received in a conformed opening 164 in an adjusting wheel 166. A spring retaining ring 168 is received in a groove formed in the end of the pin to retain the wheel 166 in place. As the lower end of the lever 18 is moved away from and toward the frame 12, the upper end of the lever 18 and the drive link 144, which form a toggle, move the movable crimping die 16 away from and toward the fixed crimping die 14, respectively. By rotating the adjusting wheel 166 the pin 152 is rotated and the pivot point of the drive link is moved with respect to the frame 12, thereby altering the stroke of the movable crimping die 16. A series of scallops 170 are formed in the outer periphery of the wheel 166. A screw 172 is arranged in threaded engagement with one of a pair of threaded holes 174 formed in the left elongated member 22. The hole is positioned so that the screw also engages one of the scallops 170, thereby preventing rotation of the adjusting wheel without first removing the screw. A return extension spring 176 has one end attached to a pin 178 that extends between the left and right elongated members 22 and 24 and through holes 180 formed therein. The other end of the return spring is coupled to the upper end of the lever 18 by means of a U-shaped member 182 having a pair of outwardly formed ends 184 that extend through a hole 186 formed through an end of each of the left and right lever members 110 and 112. The holes 186 are positioned so that the return spring 176 urges the lower end of the lever 18 outwardly away from the frame 12, thereby urging the movable crimping die 16 in a direction away from the fixed crimping die 14. As best seen in FIG. 5, the drive link 144 includes an arcuate surface 188 which is a segment of a circle having a radius 190 that has its center at the center of the hole 150. A series of serrations 192 are formed on the surface 188 and are arranged to engage a tang 194 extending from a pawl 196, as best seen in FIG. 4. The pawl 196 is pivotally attached to the lever 18 by means of a pivot pin 198 that extends through holes 200 formed through the left and right lever members and a hole 202 formed through the pawl. A relatively short extension spring 204 has one end

attached to the pawl 196 and the other end attached to a pin 206 that extend through holes 208 formed through the left and right lever members 110 and 112. The spring 204 tends to urge the pawl into a neutral position so that the tang 194 is normal to the serrated surface 188, however, the pin 198 is positioned so that the tang is in interfering engagement with the serrations 192 when the pawl is adjacent the surface 188. As will be explained, this operates to compel continued movement of the lower end of the lever 18 toward or away from the frame 12 once the tang has fully engaged one of the serrations. As best seen in FIG. 4, the tool 10 includes an optional pair of handles 210 and 212 that are made from rubber or plastic and shaped to be comfortable to an operator of the tool. The handle 210 includes a cavity 214 that is shaped to receive the lower ends of the left and right elongated members 22 and 24, while the handle 212 includes a cavity 216 that is shaped to receive the lower ends of the left and right lever members 110 and 112.

The operation of the tool 10 will now be described with reference to FIGS. 6, 7, and 8. The tool 10 is in its fully open position, as shown in FIG. 6, with the lever 18 pivoted away from the frame 12 as far as possible. A conductor having a terminal positioned thereon, not shown, is inserted into the opening 220 between the fixed and the movable crimping dies 14 and 16. The lever 18 is then manually moved toward the frame 12, in the usual manner, to begin the crimping operation. As this movement continues, the mechanism pivots about the pins 128, 146, and 152 so that the pin 128 moves toward the left, as viewed in FIG. 6, the flats 130 moving along the elongated holes 132 while the drive link 144 and the portion of the lever 18 between the pins 128 and 146 act as a toggle linkage. The tang 194 of the pawl 196 then engages the teeth 192 of the arcuate surface 188 causing the pawl to pivot counterclockwise, as shown in FIG. 7, the spring 204 retaining the tang in engagement with the teeth. The tang 194, being canted toward the left from a normal to the arcuate surface 188, as viewed in FIG. 7, prevents movement of the lever 18 in the opposite direction, away from the frame 12, until the lever 18 has been moved fully toward the frame to the position shown in FIG. 8. At this point the movable crimping die 16 has moved linearly along the linear path until the terminal and conductor are crimped between the fixed die form 86 and movable die form 134. The tang 194 has reached past the last tooth 192 on the arcuate surface 188 and the spring 204 has caused the pawl 196 to pivot clockwise to its neutral position. At this point the crimping operation is complete and the lever 18 is allowed to pivot away from the frame 12 under the urging of the spring 176. As the lever 18 moves away from the frame the pin 128 moves along the linear path 20 toward the pin 152 thereby moving the movable crimping die 16 away from the fixed crimping die 14 and the tang again engages the teeth 192 causing the pawl 196 to pivot further clockwise as the tang skips across the teeth. This pivotal movement of the lever 18 away from the frame 12 continues until the tool is in its fully open position, shown in FIG. 6. It will be appreciated by those skilled in the art that the lever 18 is pivotally attached to the drive link 144 at the same point as the center of radius of the arcuate surface 188, so that the pivot pin 198 of the pawl 196 maintains a fixed distance from the arcuate surface 188 as the lever 18 is moved with respect to the frame 12. This assures a simplified pawl and ratchet structure that supports the desired linear movement of the movable crimping die.

An important advantage of the present invention is that the closed structure of the frame 12 around the opening 220 assures a stronger yet light weight tool that will not appre-

ciably deflect under the stress of the crimping operation, unlike the prior art C-shaped frame structures. Further, the movement of the movable die is linear movement, thereby eliminating any tendency of the terminal to roll during the crimping operation. Additionally, This linear movement is supported by a simplified pawl and ratchet structure.

We claim:

1. A tool for crimping an electrical component onto a conductor to form a crimped connection comprising:

- a frame having a guideway;
- a fixed crimping tool secured to said frame;
- a movable crimping tool arranged to slide along a linear path within said guideway in said frame in a first direction toward said fixed crimping tool and in a second opposite direction;
- a link having a first end pivotally attached to said frame and a second end spaced therefrom;
- a lever having a free end, a second end opposite said free end pivotally attached to said movable crimping tool, and another end pivotally attached to said second end of said link at a point between said free end and said second end opposite thereof, said lever being arranged so that when said free end is moved toward said frame through a specific distance said movable crimping tool is moved in said first direction wherein said second end of said lever is slidably extendable along a path coincident with the linear path of said guideway thereby effecting said crimping of said terminal and when moved away from said frame said movable crimping tool is moved in said second direction;
- a series of teeth arranged to form a ratchet surface on said link; and
- a pawl pivotally attached to said lever and arranged to engage said teeth of said ratchet surface upon movement of said free end toward said frame and, once so engaged, to compel said movement of said free end through said specific distance, and into and in guided relationship with said elongated hole in said frame.

2. The tool according to claim 1 wherein said ratchet surface is a portion of a circle having a center of radius at said pivotal attachment of said lever to said link.

3. The tool according to claim 2 wherein said pawl is arranged to move along an arc having a center of radius coincident with said center of radius of said ratchet surface when said free end of said lever is moved said specific distance.

4. The tool according to claim 1 wherein when said free end of said lever is moved toward said frame said specific distance said movable crimping tool and said fixed crimping tool are spaced apart a distance defining a shut height for said tool, and wherein said pivotal attachment of said link to said frame is effected by means of a pin in engagement with a hole in said frame and said pin having an eccentric diameter in engagement with a hole in said link, said pin arranged to be manually rotated for adjusting said shut height to a desired value.

5. The tool according to claim 1 including an elongated hole in said frame having a longitudinal axis parallel to said linear path and wherein said pivotal attachment of said second end of said lever to said movable crimping tool includes a pin extending through a hole in said lever, through a hole in said movable crimping tool, and into and in guided relationship with said elongated hole in said frame.

6. The tool according to claim 1 wherein said frame includes two spaced apart elongated members, each of which has a top portion attached to said fixed crimping tool,

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two side portions extending from said top portion on opposite sides of said linear path, and a bottom portion spaced from said top portion and attached to said two side portions, and wherein said movable crimping tool is arranged to slide along said linear path between said two elongated members.

7. The tool according to claim 6 wherein said two side portions of one of said elongated members form an opening between said top and bottom portions, said opening being

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said guideway and said movable crimping tool having a projection extending into said opening and in sliding engagement with said two side portions.

8. The tool according to claim 6 including spacers disposed between and rigidly attached to said two elongated members.

* * * * *

United States Patent [19]
 Nilsson et al.

[11] Patent Number: 5,509,291
 [45] Date of Patent: Apr. 23, 1996

[54] **CRIMPING TOOL**

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[21] Appl. No.: 313,303

[22] PCT Filed: Apr. 5, 1993

[86] PCT No.: PCT/SE93/00291

§ 371 Date: Oct. 6, 1994

§ 102(e) Date: Oct. 6, 1994

[87] PCT Pub. No.: WO93/19897

PCT Pub. Date: Oct. 14, 1993

[30] **Foreign Application Priority Data**

Apr. 6, 1992 [SE] Sweden 9201087
 Feb. 19, 1993 [SE] Sweden 9300564

[51] Int. Cl.⁶ H01R 43/042

[52] U.S. Cl. 72/409.14; 72/451; 29/751;
 81/313; 81/376; 81/380

[58] Field of Search 72/410, 409, 451;
 29/751; 81/376, 378, 380, 313

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[57] **ABSTRACT**

A crimping tool includes first and second jaws (1, 2) which are journaled at a first pivot point (5) for pivotal movement relative to one another. A forward end of a first handle (6) is rigidly connected to the first jaw (1), while a forward end of a second handle (7) is pivotally connected to the second jaw (2) at a second pivot point (8). A linkage construction (9) extends obliquely rearwards from a third pivot point (10) located on the second handle (7) rearwardly of the second pivot point (8), up to a fourth pivot point (11) on the first handle (6). The distance (D) between the first and the second pivot points (5, 8) is 0.30–0.35 times the distance (A) between the first and the fourth pivot points (5, 11), the distance (C) between the second and the third pivot points (8, 10) is 0.20–0.25 times the distance (A) between the first and the fourth pivot points (5, 11), and the distance (B) between the third and the fourth pivot points (10, 11) is 0.62–0.66 times the distance (A) between the first and the fourth pivot points (5, 11). In the closed position of the jaws (1, 2) a plane (E) which contains the second and the third pivot points (8, 10) defines an angle (α) of 165°–180° with a plane (F) which contains the third and the fourth pivot points (10, 11), with the apex of the angle facing away from the first handle (6).

21 Claims, 5 Drawing Sheets .

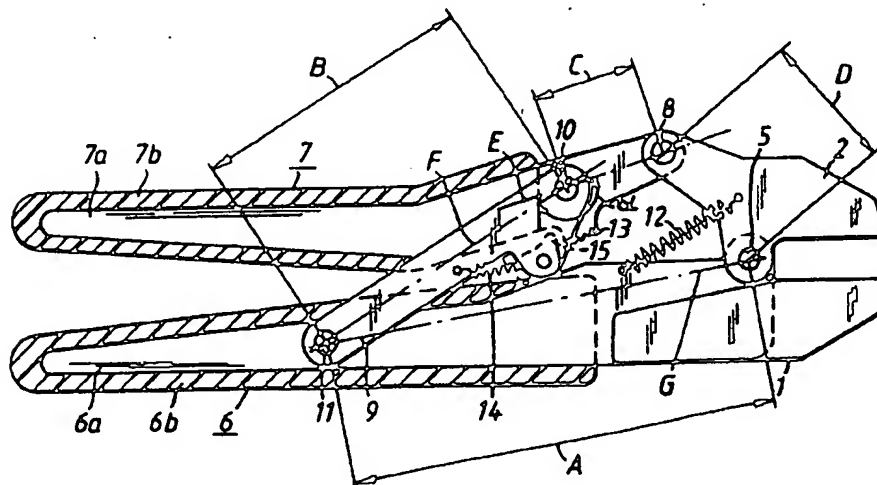


Fig. 3

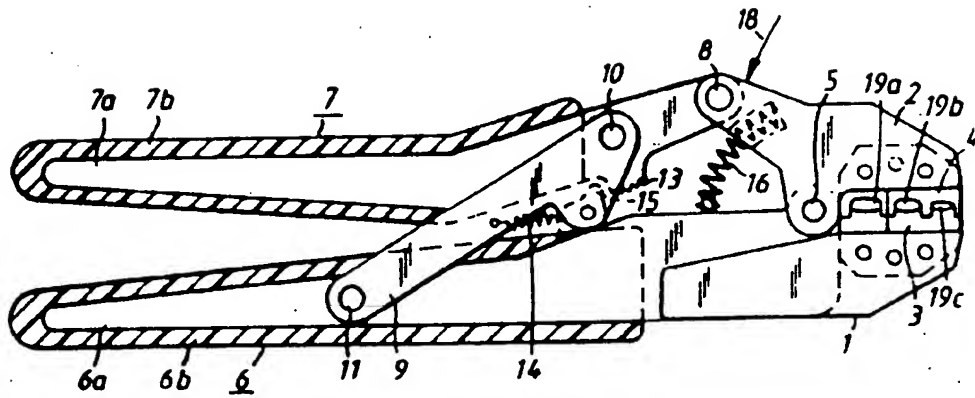


Fig. 4

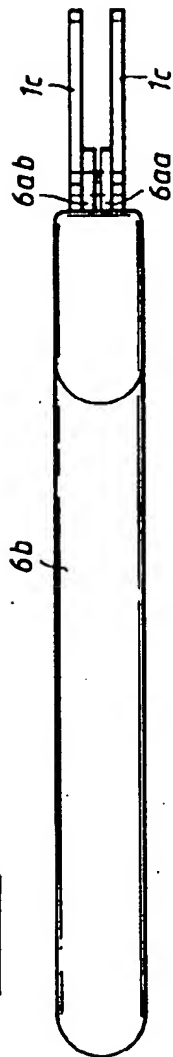


Fig. 5

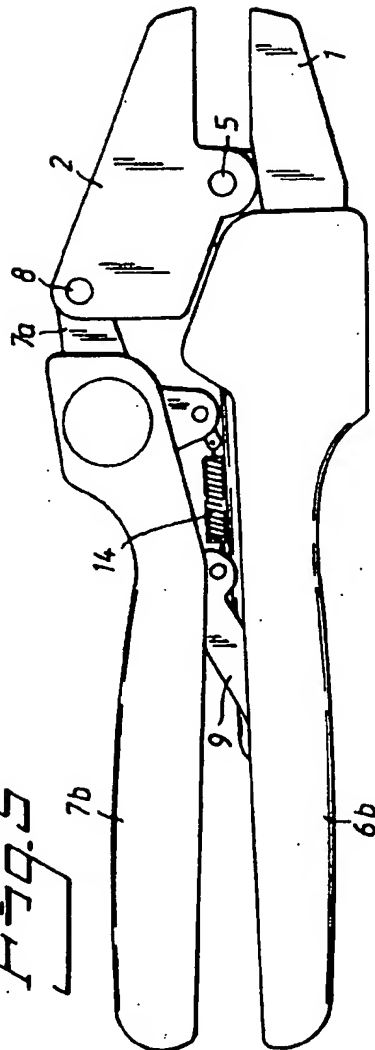
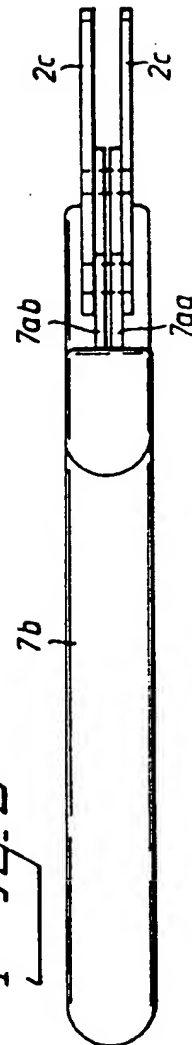
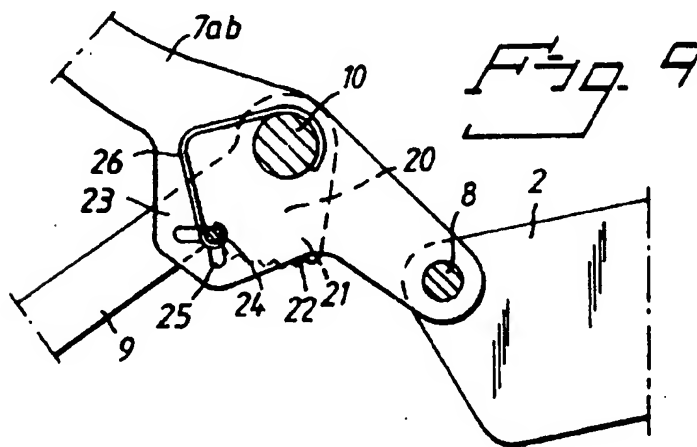
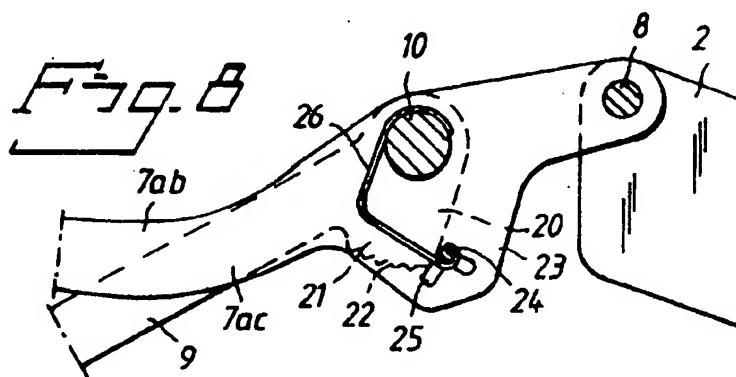
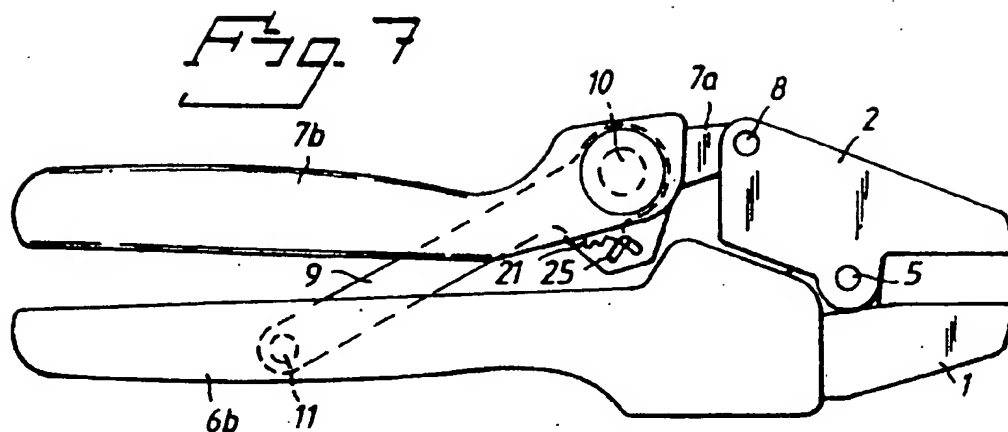
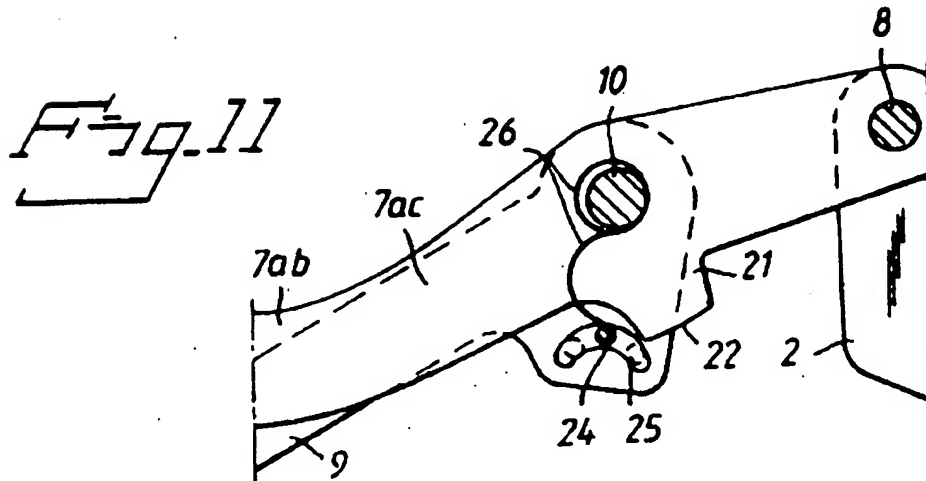
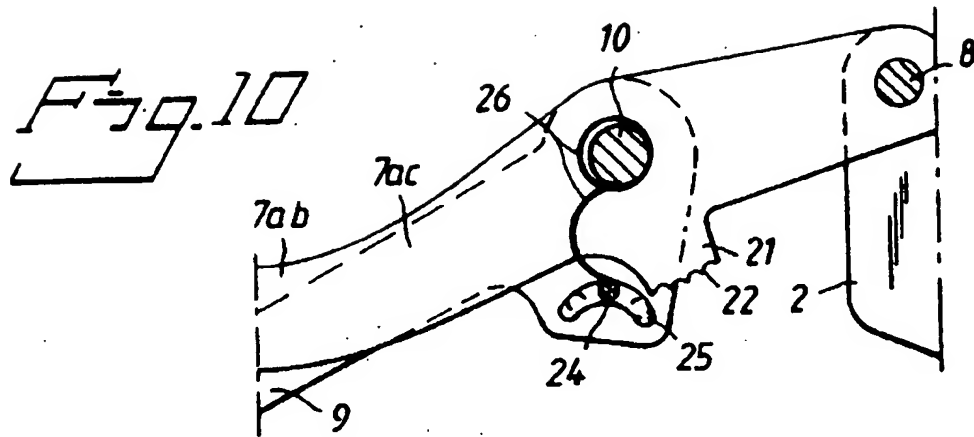


Fig. 6







CRIMPING TOOL

This application is a 371 of PCT/SE93/00291, filed Apr. 5, 1993.

The present invention relates to a crimping tool for, e.g., manually crimping electrical terminal contacts onto the ends of cables, and being of the kind which includes first and second crimping jaws each of which is provided with an individual crimping part and which are journaled in relation to one another at a first pivot point for pivotal movement between an open position and a closed crimping position, and which includes first and second handles which are intended for pivoting the jaws and which extend rearwardly from said jaws, wherein the first handle is rigidly connected to the first jaw at a front end of said first handle whereas the second handle is pivotally connected to at least a part of the second jaw at a front end of the handle in a second pivot point located rearwardly of the first pivot point, and wherein a linkage construction extends obliquely rearwards from a third pivot point on the second handle, rearwardly of said second pivot point, up to a fourth pivot point on the first handle.

Such tools (see for instance GB-A-1 522 144 and DE-C-2 555 071) are used to a large extent in the manufacture and installation of electrical and electronic devices. When using these known tools, it is necessary to exert relatively considerable force in order to complete the crimping operations concerned, resulting in tiredness of the tool operator and in the risk of causing bodily strain to an operator who is required to carry out such operations regularly.

The present invention is based on the problem of providing a novel and advantageous crimping tool of the kind defined in the introduction, whose construction is such that the tool will be essentially optimized from an ergonomical aspect, so as to eliminate at least substantially the problems associated with such tools.

With the intention of solving the aforesaid problem, it is proposed in accordance with the invention that the distance between the first and the second pivot points is 0.30–0.35 times the distance between the first and the fourth pivot points, that the distance between the second and the third pivot points is 0.20–0.25 times the distance between the first and fourth pivot points, and that the distance between the third and the fourth pivot points is 0.62–0.66 times the distance between said first and said fourth pivot points, and that in the closed crimping position of the jaws a plane which contains the second and the third pivot points, with the an angle within the range of 165°–180° with a plane which contains the third and the fourth pivot points, with the apex of the angle facing away from a plane that contains the first and the fourth pivot points.

Other objects of the invention are to provide a crimping tool which is constructed of flat parts, to provide a crimping tool which is capable of gripping objects, for instance a cable end and a cable shoe which is to be crimped onto said cable end, so that a two-hand grip can be used if so desired, and to provide a crimping tool which is provided with an improved marking device for indicating that a crimping tool movement has been completed. These and other objects described in the following description are achieved with a crimping tool having the characteristic features set forth in the depending claims.

The invention will now be described in more detail with reference to chosen exemplifying embodiments thereof and also with reference to the accompanying drawings.

FIGS. 1–3 illustrate schematically and in side view a first, second and third embodiment of the inventive crimping tool respectively.

FIGS. 4–6 are respectively a view from beneath, a side view and a view from above of a fourth embodiment of the inventive crimping tool.

FIG. 7 shows in side view a fifth embodiment of the inventive crimping tool.

FIGS. 8 and 9 are central longitudinal sectional views in larger scale of a portion of the tool of FIG. 7 provided with a marking device which prevents the interruption of an initiated crimping tool movement prior to said movement being completed.

FIGS. 10 and 11 are views similar to the views of FIGS. 8 and 9 and illustrate alternative embodiments of the marking device.

All identical or essentially identical tool elements shown in the drawings have been identified with the same reference signs.

FIG. 1 illustrates a closed crimping tool which includes first and second jaws 1,2 which are intended to carry jaw inserts which function, for instance, to crimp terminal contacts onto electrical conductors. Such jaw inserts are shown only in FIG. 3 and are there referenced 3 and 4. The jaws 1,2 are journaled at a first pivot point 5 for pivotal movement relative to one another between the illustrated, closed position and an open position (not shown) which enables, for instance, a cable end and a terminal contact to be crimped onto the cable end to be inserted between the inserts 3, 4 on the open jaws. The tool also includes first and second handles, generally referenced 6 and 7 respectively, which extend rearwardly from the jaws 1, 2. Each handle is comprised of a metal handle body 6a, 7a which in the regions intended to be held by the user during a crimping operation are provided with outer coverings or outer handles 6b, 7b, which are made of a plastic material for instance and have a grip-friendly shape. The first handle is rigidly connected to the first jaw 1. In the illustrated embodiment, a forwardly extending part of the handle body 6a forms a rear part of the jaw 1 and the first pivot point 5 is located on this part of the handle body. The other handle 7 is pivotally connected to the second jaw 2 by means of a second pivot point 8 located at a forward end of the handle, wherein the second pivot point 8 is located rearwardly of the first pivot point 5. A linkage construction 9 extends obliquely rearwardly from a third pivot point 10 located on the second handle 7 rearwardly of the second pivot point 8, up to a fourth pivot point 11 on the first handle 6.

In order to provide a crimping tool with essentially optimum ergonomic properties, the distance D between the first and the second pivot points 5,8 is 0.30–0.35 times, suitably about 0.32 times the distance A between the first and the fourth pivot points 5,11, while the distance C between the second and the third pivot points 8,10 is 0.20–0.25 and suitably about 0.24 times the distance A, and the distance B between the third and the fourth pivot points 10,11 is 0.62–0.66, suitably about 0.64 times the distance A. In the closed position of the tool, a plane E extending perpendicularly to the plane of the drawing and containing the pivot points 8 and 10 defines an angle α within an angular range of 165°–180° with a plane F that contains the pivot points 10 and 11, with the apex of the angle facing away from a plane G that contains the pivot points 5,11.

In the case of the illustrated embodiments, the tool handle bodies 6a, 7a are located in mutually the same plane, and the linkage construction 9 is comprised of two similarly planar and mutually identical linkage arms which are each located on a respective side of the handle bodies and of which the linkage arm located nearest the viewer of FIGS. 1–3 and 5 and 7 hides the linkage arm located behind the

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linkage arm visible in the drawings. A portion 7ac (FIGS. 2,8,10,11) of the second handle body 7a located rearwardly of the third pivot point 10 may to advantage be located between and extend substantially in parallel with the two linkage arms of the linkage construction 9 in the closed crimping position of the tool. The handle body 7a is then curved so as to extend substantially in parallel with the first handle 6. Suitably, said portion 7ac has a length of the order of magnitude of half the distance between the pivot points 10 and 11. This arrangement, particularly in combination with the location of the pivot point 8 rearwardly of the pivot point 5 in the closed position of the tool, enables the distance between the handles 6 and 7 to be chosen to become particularly advantageous from an ergonomic aspect both in the open position and the closed position of the tool.

The first jaw 1 includes two plates 1c which are firmly connected to a respective side of the handle body 6a (see in particular FIG. 4) and between which a crimping part 3 (FIG. 3) is intended to be fixed. Similarly, the second jaw 2 includes two plates 2c each of which is located on a respective side of the handle bodies 6a and 7a, (see in particular FIG. 6) and which are journaled for pivotal movement in relation to both the body 6a and the body 7a and between which a crimping part 4 (FIG. 3) is intended to be fixed. The construction of the tool components in the form of flat or plate-like elements is favourable from the aspect of mechanical strength. As will be seen from FIGS. 4 and 6, the handle body 6a, 7a may be constructed from two flat parts 6aa, 6ab and 7aa, 7ab which are placed side-by-side at a short distance apart.

The reference numeral 12 in FIG. 1 identifies a pull spring which functions to pivot the jaw 2 anti-clockwise around the pivot point 5 and therewith pivot the handle 7 clockwise around the pivot point 10 unless the handle 6, 7 are pressed towards the tool closing position. In order to prevent, in a known manner, interruption of a crimping operation before the jaws 1, 2 have been swung to their fully closed position, or to prevent interruption of a tool opening movement, the handle 7 is provided with a toothed ring part 13 which is concentric with the point 10 and which is intended to coact with a latch pawl 15 pivotally journaled on the linkage construction 9 and pivoting against the action of a pull spring 14. It will be understood that the pawl 15 must be located either forwardly or rearwardly of the toothed ring part before the tool can be closed or opened. Such an arrangement is illustrated in and described in, for instance, the patent specifications mentioned in the introduction.

In order to enable the jaws to be set to a desired closed position and to adjust the closed position of the tool when the tool becomes worn, in a similarly known manner, one of the journal pins at the pivot points, suitably the pivot pin at the pivot point 10 is provided in a known manner (not illustrated here) with a cylindrical part journaled centrally in one handle body and two cylindrical parts which are located on opposite sides of the central part and which, depending on the position of the journal pin, are journaled in the two linkage arms of the linkage construction 9 or in the plates 2c on the jaw 2 and which are mutually coaxial but eccentric in relation to said central part. The journal pin for adjusting the desired jaw closed position is therewith rotatable and lockable in the set position of rotation. Such an arrangement is illustrated and comprehensively described in, for instance, the patent specifications mentioned in the introduction.

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The tool illustrated in FIG. 1 is opened automatically by the pull spring 12. When performing a crimping operation, the objects to be crimped, for instance a terminal contact fitted to the end of a bared cable end, is inserted between the crimping parts 3, 4 of the fully open jaws 1, 2 (not shown in FIG. 1), whereafter the handles are swung towards one another while manually holding said objects in position between the jaws until the pawl 15 lies behind the toothed ring part 13, whereupon the crimping operation is complete. It will be understood that the linkage construction 9 and the pivotal handle 7 form a toggle mechanism which when pivoting the handle 7 anticlockwise with a moderate force causes the second jaw 2 to pivot clockwise with a greater force during a crimping operation. In order to avoid damage to the tool, the tool will preferably have a certain degree of resiliency, while at the same time ensuring that a requisite crimping force will definitely be achieved. Preferably, the tool will have an intrinsic resiliency such that the jaws 1, 2 can swing apart through an angle of 5°, preferably an angle of about 10°, from a closed crimping position brought about by means of the handles 6, 7, without any residual deformation of the tool. In a corresponding manner the handles 6, 7 shall be able to swing to the closed position without any residual deformation of the tool, even if an incompressible object between the jaws 1, 2 maintains said jaws swung apart an angle of up to 5° or 10°, respectively.

FIG. 2 illustrates a tool embodiment which enables an object, for instance a terminal contact, to be firmly clamped between the crimping parts 3, 4 of the jaws 1, 2 prior to swinging the handles 6, 7 towards one another, for instance, so that the handles can be swung towards each other with a two-hand grip. To this end, the crimping jaw 2 is comprised of a first jaw part 2a in the form of a linkage arm which extends between the pivot points 5 and 8 and a second jaw part 2b which is intended to carry the crimping part 4 and which is journaled at the pivot point 5. A pressure spring 16 acting between the jaw parts 2a and 2b functions to swing both the jaw part 2b and the handle 7 clockwise around respective pivot points 5 and 10. A journal pin mounted in the pivot point 8 projects out on both sides of the handle 7 and is intended to be received in recesses 17 in the jaw part 2a, at least at the end of a crimping operation. The tool illustrated in FIG. 2 will thus normally take the position shown in the Figure. An object is clamped between the jaws, by pressing down the jaw part 2b in the direction of the arrow 18 against the action of the spring 16, whereupon the object is inserted between the jaws and the jaw part 2b is permitted to swing back towards the closed position. The handle 7 is then swung anticlockwise against the action of the spring 16, wherein the journal pin extending through the pivot point 8 gradually engages the recesses 17 and swings the jaw part 2b to its fully closed position, in which the latching pawl 15 is located behind the toothed ring part 13. In other respects, the tool is constructed in the manner described with reference to FIG. 1. The rear end of the linkage arm 2a is received in a space between the parts 7aa, 7ab forming the handle 7 (FIG. 6).

The tool illustrated in FIG. 3 is constructed in a similar manner to the tool illustrated in FIG. 1, with the exception that a pressure spring 16 acting between the handle 6 and the jaw 2 strives to hold the tool closed. The tool is opened fully by applying pressure in the manner indicated by the arrow 18, whereafter, for instance, a terminal contact is clamped firmly by introducing the terminal contact into a corresponding recess 19a, b or c in the crimping parts 3, 4 and then permitting the jaw 2 to swing back to its closed position under the action of the spring 16. The crimping operation is

then completed, by moving the handles 6, 7 towards each other until the latching pawl 15 is located behind the toothed ring part 13.

FIGS. 4-6 illustrate the manner of tool construction when the handle bodies have the form of double flat elements 6aa, 6ab and 7aa, 7ab. It will also be seen that the jaws 1 and 2 are constructed from sheet-like elements 1c and 2c. In other respects, the tool illustrated in FIGS. 4-6 is constructed in the same manner as that described with reference to FIG. 1.

FIG. 7 illustrates a closed crimping tool resembling the tool illustrated in FIGS. 4 to 6. The tool of FIG. 7 is provided with a marking device 21 to 26 which, similar to the above described elements 13 to 15, can be adapted to prevent swinging of the handles 6, 7 in one direction before a swinging movement of the handles in an opposite direction has been completed. The construction of this type of marking device is shown in detail in FIGS. 8 to 10, while FIG. 11 shows a marking device which, although it indicates that a tool movement has been completed, does not prevent interruption of a tool movement before completion thereof. In the tool of FIG. 7, whose marking device 21 to 26 thus prevents interruption of a crimping operation before the jaws 1,2 have been swung to their fully closed position and prevents interruption of a tool opening movement, the linkage arms of the linkage construction 9 are provided with parts 20 having cams 21. These cams have an abruptly decreasing height at the ends thereof and a toothed camming surface 22 therebetween which is arcuately curved with the center of the arc in the point 10, as is clearly shown in FIGS. 8 and 9. Each cam 21 coacts with a cam follower 24 which is mounted in a generally V-shaped slot 25 formed in a part 23 of the handle body 7a and projects out from both sides of the said handle body. A spring 26 acting between the cam follower 24 and the point or pin 10 strives to pull the cam follower into the base-part of the V-shaped slot. It will be seen that the cam follower 24 must be located forwardly or rearwardly of the ends of the cams 21 before the tool can be opened and closed respectively, as is also evident from the above description of the elements 13 to 15. The legs of the slot 25 extend obliquely away from the camming surface 22. When that portion of the part 23 which carries the slot 25 is located between the ends of the camming surface 22, the cam 21 covers the base-part of the slot 25. Thus, when the part 23 moves to the left in FIG. 8, the cam follower 24 is cammed by the cam end-part into the rearward leg, as seen in the direction of movement. The cam follower 24 is held constantly in contact with the camming surface 22 by the action of the spring 26. When the movement has been completed, the cam follower 24 leaves the camming surface 22 and snaps down into contact with the base-part of the V-shaped slot 25, wherewith the arrangement may be constructed so as to obtain a visual indication or marking when the movement has been completed. Optionally, the described arrangement may be so constructed that the position of the cam follower 24 cannot be seen when the movement has been completed, or can only be seen with difficulty. In this regard, the indication may be solely an acoustic indication, i.e. the indication is given by the clicking sound produced when the cam follower 24 snaps down into contact with the base-part of the slot 25. When the part 23 moves back to the right in FIG. 9, the cam follower 24 is cammed into the now rearward slot leg. When the cam follower finally has passed along the entire camming surface 22, it again snaps down into the base-part of the slot 25 in the manner shown in FIG. 8.

The tool illustrated in FIG. 7 is opened automatically by the pull spring (not shown) acting between the jaw 2 and the handle 6. When performing a crimping operation, the articles concerned, for instance a terminal contact to be crimped onto the bared end of a cable, are inserted between the crimping parts (not shown) carried by the fully opened jaws 1,2, the handle 7 being swung upwards from the position illustrated in FIG. 7 in the manner illustrated in FIG. 9. While holding the articles manually in position between the jaws, the handles 6, 7 are swung towards one another until the slot 25 is located forwardly of the camming surface 22, as shown in FIG. 8, wherewith the crimping operation is completed.

As before mentioned, FIGS. 8 and 9 are central longitudinal sectional views of the indicating or marking device of the tool according to FIG. 7. The section is thus taken between the body parts of the handle 7 so that only the body part 7ab and the one linkage arm 9 located therebeneath are visible. Both this body part 7ab and the upper body part (not shown in FIGS. 8 and 9) are provided with mutually opposite slots 25. The cam follower 25 extends through the two slots and the opposite ends of the cam follower coact with respective toothed camming surfaces 22 on each of the parts 20 of the linkage arms. The spring 26 is located between the mutually covering body parts 7aa, 7ab and is thus fully protected thereby. As is particularly evident from FIGS. 7 and 8, the portion 7ac of the handle 7 and the handle body 7a, respectively, located adjacent the shaft or point 10 extends substantially in parallel with the linkage arms 9. This arrangement in combination with the chosen mutual ratios of the distances between the pivot points 5,8,10,11 results in a moderate, ergonomically favourable distance between the handles 6 and 7, both in the open and the closed position of said handles. As can be clearly seen in FIGS. 5 and 7, the handle covering 7b is extended forwardly to cover the pivot point or joint 10 which, as described above, suitably is associated with means for setting a desired closing position for the jaws 1,2 and adjusting said closing position when the tool becomes worn.

FIGS. 10 and 11 are views similar to FIG. 8. The cam 21, however, is mounted on the handle body 7a, whereas U-shaped slots 25 are disposed in the linkage construction 9. The cam follower 24 is guided at opposite ends thereof in the slots 25 in the linkage parts 9, while the center part of the cam follower is intended to coact with the cam 21 on the handle body 7a located between the linkage arms. Respective section views of FIGS. 10 and 11 are taken in the same way as the section views of FIGS. 8 and 9, and consequently only the bottom linkage arm and the body part 7ab located nearest thereto can be seen. The spring 26 acting between the cam follower 24 and the pivot pin 10 is fully protected between the body parts 7aa, 7ab. The cam surface 22 of the FIG. 10 embodiment is toothed and operates in the manner described with reference to FIGS. 7 to 9, whereas the cam surface of the FIG. 11 embodiment is smooth and does not prevent reversal of a tool movement before it has been completed.

The invention is not restricted to the aforedescribed and illustrated embodiments, but can be realized in any desired manner within the scope of the inventive concept defined in the following Claims.

We claim:

1. A crimping tool comprising first and second jaws (1, 2) each of which is provided with a crimping part (3, 4) and which are journaled in a first pivot point (5) for relative pivotal movement between an open position and a closed crimping position, and which further comprises first and

second handles (6, 7) for pivoting the jaws and extending rearwardly from said jaws (1, 2), of which handles the first handle (6) is rigidly connected at a forward end to the first jaw (1), whereas the second handle (7) is pivotally connected to at least a part of the second jaw (2) at a forward end in a second pivot point (8) located rearwardly of the first pivot point (5), and further comprises a link construction (9) which extends obliquely rearwards from the a third pivot point (10) located on the second handle (7) rearwardly of the second pivot point (8), to a fourth pivot point (11) located on the first handle (6), characterized in that the distance (D) between the first and the second pivot points (5, 8) is 0.30–0.35 times the distance (A) between the first and the fourth pivot points (5, 11), the distance (C) between the second and the third pivot points (8, 10) is 0.20–0.25 times the distance (A) between the first and the fourth pivot points (5, 11), and the distance (B) between the third and the fourth pivot points (10, 11) is 0.62–0.66 times the distance (A) between the first and the fourth pivot points (5, 11); and in that when the jaws (1, 2) are in their crimping position a plane (E) which contains the second and the third pivot points (8, 10) defines an angle (α) within the range of 165°–180° with a plane (F) which contains the third and the fourth pivot points (10, 11) with the apex of the angle facing away from a plane (G) which contains the first and the fourth pivot points (5, 11).

2. A crimping tool according to claim 1, characterized in that the distance (D) between the first and the second pivot points (5, 8) is about 0.32 times the distance (A) between the first and the fourth pivot points (5, 11); in that the distance (C) between the second and the third pivot points (8, 10) is about 0.24 times the distance (A) between the first and the fourth pivot points (5, 11); and in that the distance (B) between the third and the fourth pivot points (10, 11) is about 0.64 times the distance (A) between the first and the fourth pivot points (5, 11).

3. A crimping tool according to claim 1, characterized in that the tool has intrinsic spring properties such that the jaws (1, 2) when brought to a closed crimping position by the handles (6, 7) can be swung apart through an angle of 5°, preferably about 10° without residual deformation of the tool.

4. A crimping tool according to claim 1, characterized in that it includes handle bodies (6a, 7a) which are located in mutually the same plane; and in that the linkage construction (9) includes two mutually parallel link arms, each of which is located on a respective side of the handle bodies.

5. A crimping tool according to claim 4, characterized in that a portion (7ac) of the second handle body (7a) located rearwardly of said third pivot point (10) is located between and extends substantially in parallel with said link arms (9), whereafter said body (7a) is curved so as to extend substantially in parallel with said first handle (6).

6. A crimping tool according to claim 5, characterized in that said portion (7ac) of the second handle body (7a) has a length of the order of magnitude of half the distance between said third and fourth pivot points (10, 11).

7. A crimping tool according to claim 1, characterized in that the first jaw (1) includes two plates (1c) each of which is connected to a respective side of the first handle body (6a), and a crimping part (3) mounted between said plates.

8. A crimping tool according to claim 1, characterized in that the second jaw (2) includes two plates (2c), each of which is pivotally journaled to a respective side of the first handle body (6a), and a crimping part (4) mounted between said plates.

9. A crimping tool according to claim 1, characterized in

that the tool is spring biased towards an open position by means of a pull spring (12) which acts between the second jaw (2) and the first handle (6).

10. A crimping tool according to claim 1, characterized in that the second crimping jaw (2) includes a first jaw part (2a) in the form of a linkage arrangement extending between the first and the second pivot points (5, 8), and a second jaw part (2b) which is provided with said crimping part (4) and which is journaled at the first pivot point (5) and which is spring biased towards the closed position and is provided with a recess (17) for receiving a shaft which extends through the second pivot point (8) and which functions to press the second jaw part (2b) towards said closed crimping position when the handles (6, 7) are swung towards a jaw closing position.

11. A crimping tool according to claim 10, characterized in that the tool is spring biased towards said closed position by means of a pressure spring (16) acting between the first and the second jaw parts (2a, b).

12. A crimping tool according to claim 1, characterized in that the tool is spring biased towards said closed position and can be opened by applying pressure to the tool in the region of the second pivot point (8) in a direction towards the first handle (6).

13. A crimping tool according to claim 1, characterized in that the tool is provided with a marking device (13–15; 20–26) for indicating that a tool movement between open and closed positions or vice versa has been completed.

14. A crimping tool according to claim 13, characterized in that the marking device (13–15; 20–26) is of the type which, before completion of a commenced swinging movement of the handles (6, 7) in one direction, prevents swinging of the handles in the opposite direction.

15. A crimping tool according to claim 13, characterized in that the marking device (20–26) includes a cam (21) carried by a first tool part, said cam having a camming surface (22), suitably having an abruptly decreasing height at mutually opposite ends thereof, and a cam follower (24) carried by a second tool part which is pivotal in relation to said first tool part, wherein the cam follower is spring-biased towards the camming surface (22) and projects outwardly of and is mounted for movement along an essentially U-shaped or V-shaped guide or slot (25) formed in said second tool part adjacent said cam (21), the legs of which slot extend away from the cam (21) and the base-part of which is at least partially covered by the cam in the region of movement of the tool parts between said open and closed positions; and in that the cam follower (24) is intended to be cammed by said cam ends into the rearward leg of the U-shaped or V-shaped slot, as seen in the relative direction of movement of said second tool part, and to be held therein by the intermediate camming surface (22) extending between said cam ends, until said movement has been completed.

16. A crimping tool according to claim 15, characterized in that the intermediate camming surface (22) is toothed, such that movement of said tool parts in one direction must be completed before movement of said parts in an opposite direction can begin.

17. A crimping tool according to claim 15, characterized in that the intermediate camming surface (22) is convex arcuate; and in that the part (20) carrying the cam (21) is pivotal about a pivot center (10) which coincides with the center point of the arc.

18. A crimping tool according to claim 17, characterized in that the tool part carrying the cam (21) is pivotal about a pivot pin (10); and in that the cam follower (24) is spring-

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biased by means of a spring device (26) which acts between the cam follower and the pivot pin.

19. A crimping tool according to claim 18, characterized in that the cam (21) is mounted on the linkage construction (9) and the cam follower (24) is mounted on said second handle (7) or vice versa.

20. A crimping tool according to claim 4, characterized in that the tool includes handle bodies (6a, 7a) which are located in mutually the same plane; in that the linkage construction (9) includes two mutually parallel linkage arms, each of which is located on a respective side of said handle bodies (6a, 7a); and in that the cam follower (24) is mounted in a generally U-shaped or V-shaped slot (25) in and projects out from both sides of the second handle body (7a), and in that the linkage arms each have cam parts (22) which are located on a respective side of the handle body for engagement with the cam follower (24) and which are at

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least generally arcuate with the center of curvature located on the linkage arm pivot point (10) in the body (7a) of the second handle (7).

21. A crimping tool according to claim 20, characterized in that at least the body of the second handle (7) is comprised of two mutually parallel body parts (7aa, 7ab) which are spaced slightly apart and which contain mutually opposing, essentially U-shaped or V-shaped slots (25) through which the cam follower (24) extends; and in that a spring (26) which acts between the cam follower and a pivot pin (10) by means of which the linkage arms are journaled to the body of the second handle (7), is located between the body parts (7aa, 7ab) and strives to hold the cam follower (24) in engagement with the base-part of the U-shaped or V-shaped slot (25).

* * * * *



US00D455325S

(12) **United States Design Patent** (10) Patent No.: **US D455,325 S**
 Steiner (45) Date of Patent: * **Apr. 9, 2002**

(54) **COMPRESSION TOOL**

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(73) Assignee: **Rostra Tool Company**, Branford, CT (US)

(**) Term: **14 Years**

(21) Appl. No.: **29/147,968**

ou (22) Filed: **Sep. 13, 2001**

(51) LOC (7) Cl. **08-05**

(52) U.S. Cl. **D8/51; D8/51**

(58) Field of Search **D8/52, 32, 54, D8/55, 56, 105, 107; 72/389, 409, 409.12, 81/342, 367, 370, 418, 420, 424.5, 427.5, 380, 390, 324, 486; 29/229, 268; 269/6, 86, 96**

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(57) **CLAIM**

The ornamental design for a compression tool, as shown and described.

DESCRIPTION

FIG. 1 is a left side/front/top perspective view of a compression tool of my new design;

FIG. 2 is a right side elevational view thereof;

FIG. 3 is a left side elevational view thereof, with the compression tool in closed, compressing position;

FIG. 4 is a left side elevational view thereof, with the compression tool in open non-compressing, position;

FIG. 5 is a bottom plan view thereof;

FIG. 6 is a top plan view thereof;

FIG. 7 is a front elevational view thereof.

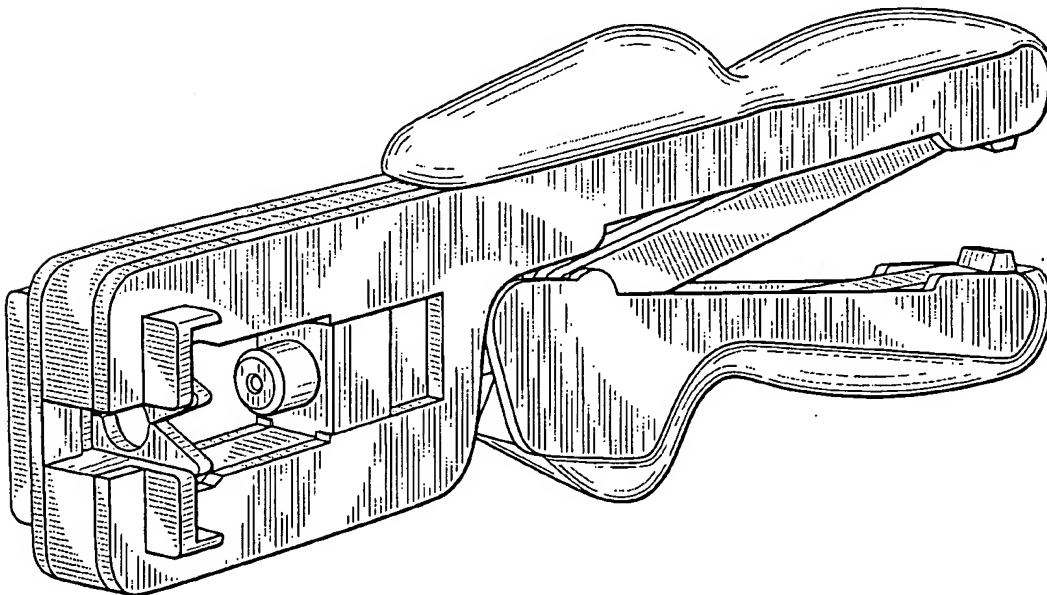
FIG. 8 is a rear elevational view thereof.

FIG. 9 is a fragmentary left side elevational view thereof, with the compression tool in open, non-compressing position; and,

FIG. 10 is a fragmentary left side elevational view thereof, with the compression tool in closed, compressing, position.

It will be understood that the materials shown in broken lines on FIGS. 9 and 10 are for illustrative purposes only and form no part of the claimed design.

1 Claim, 5 Drawing Sheets



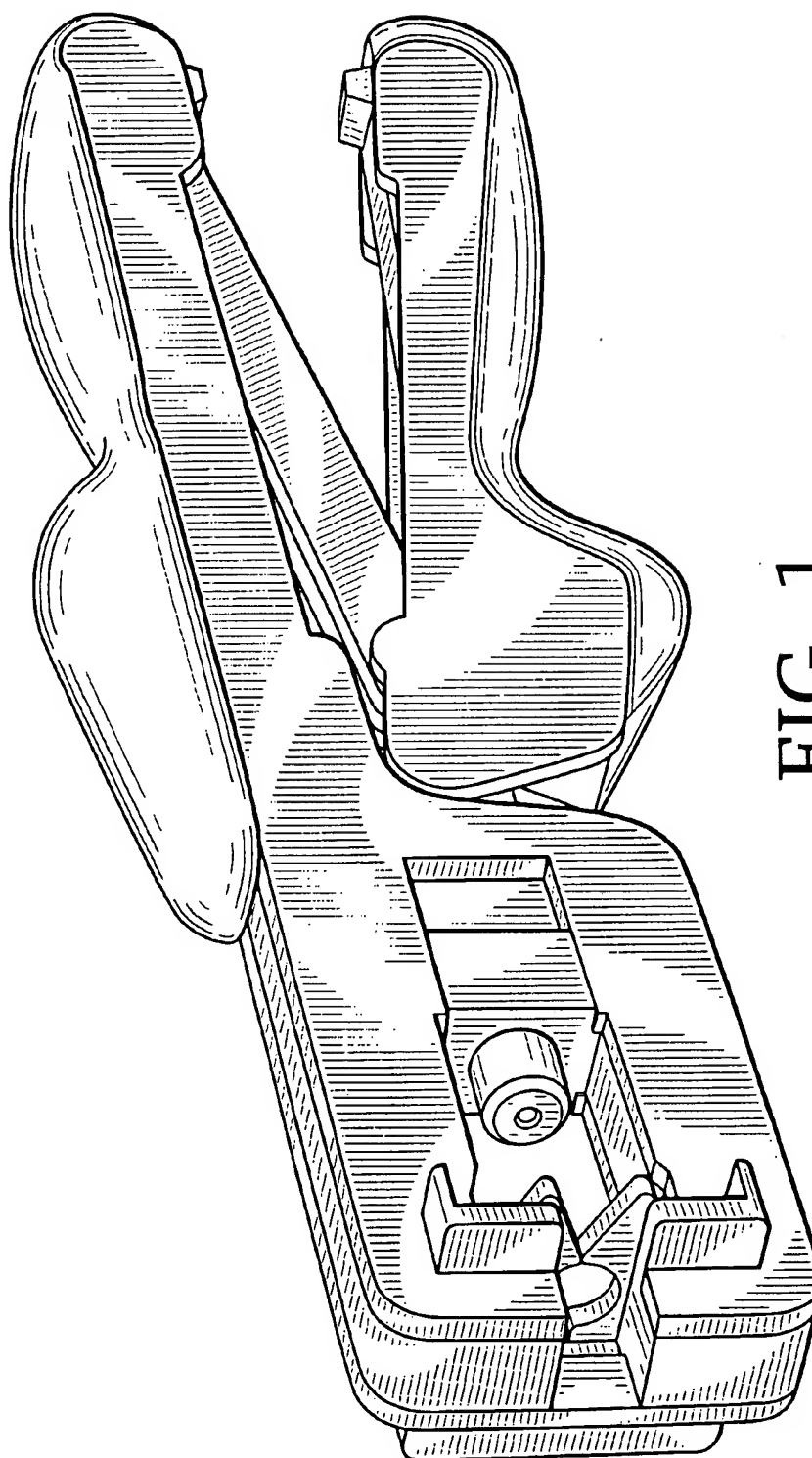
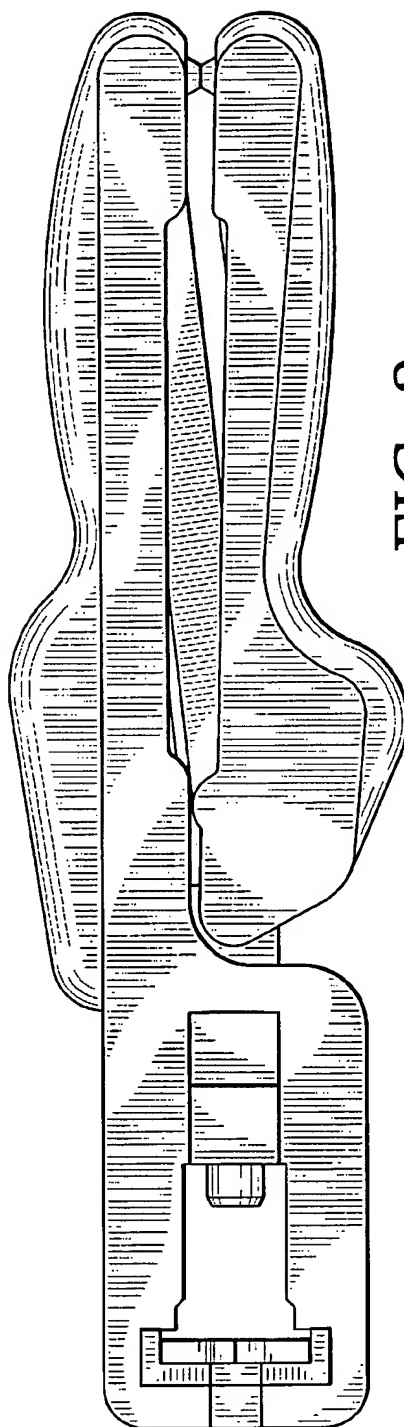
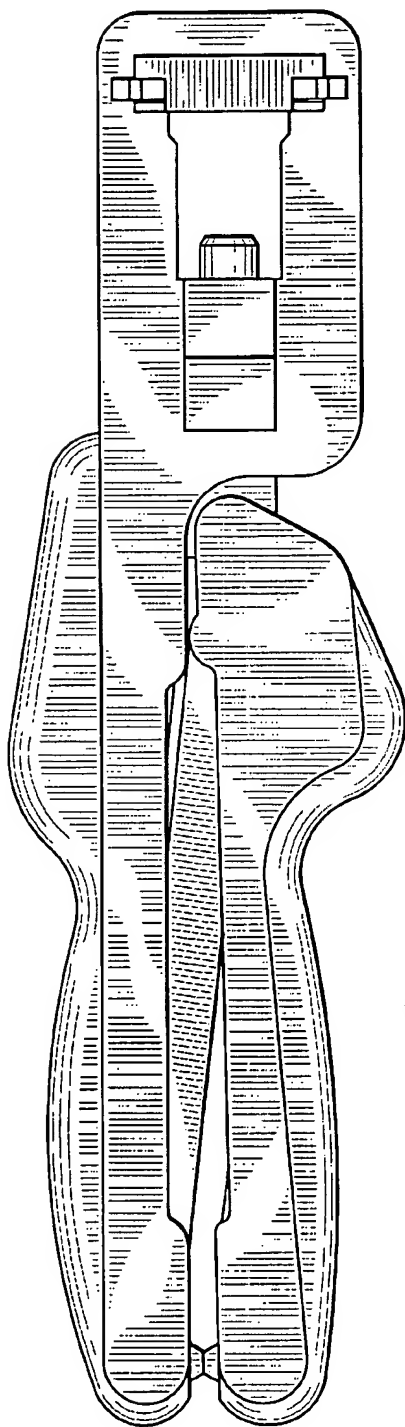
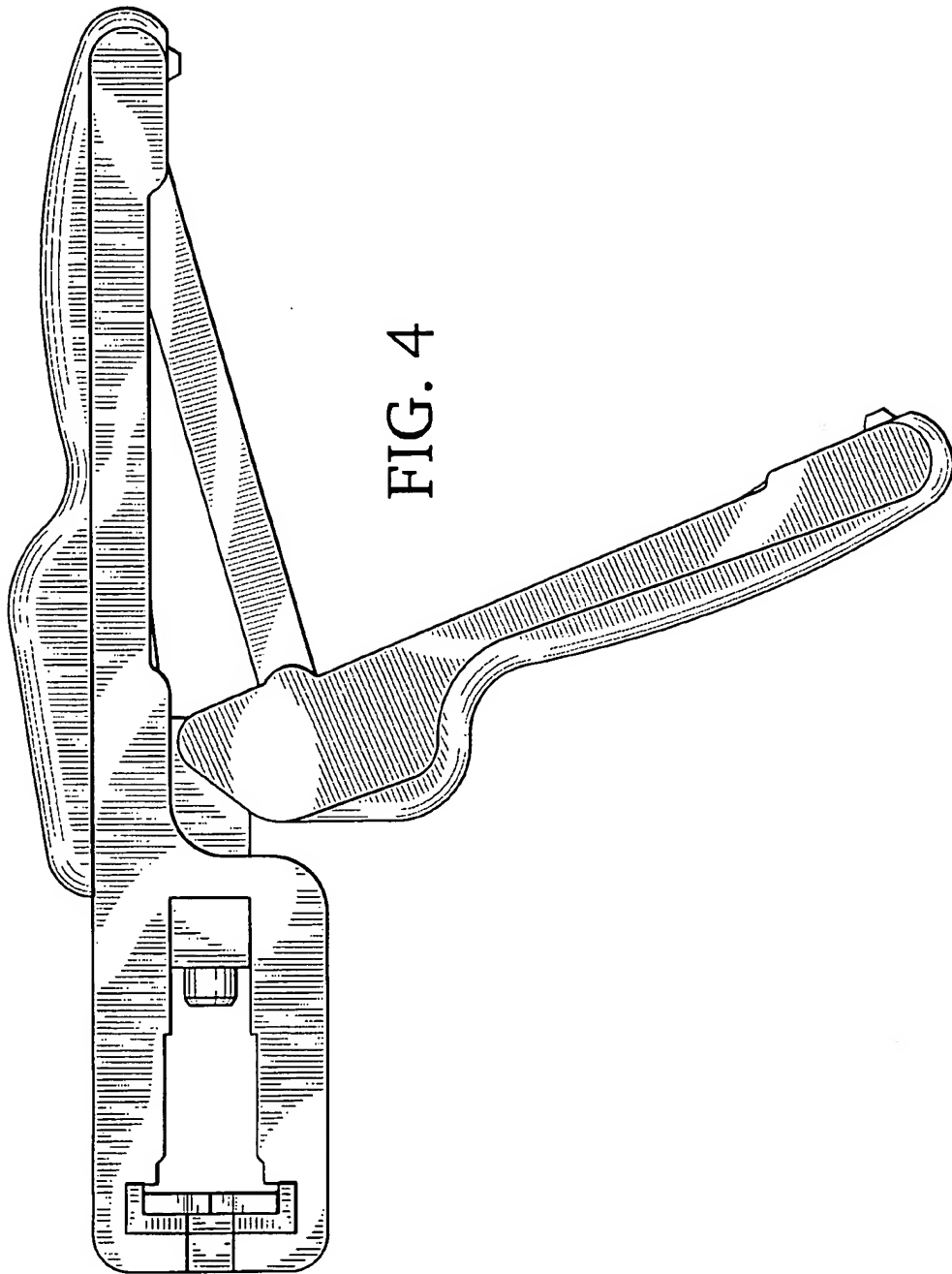


FIG. 1





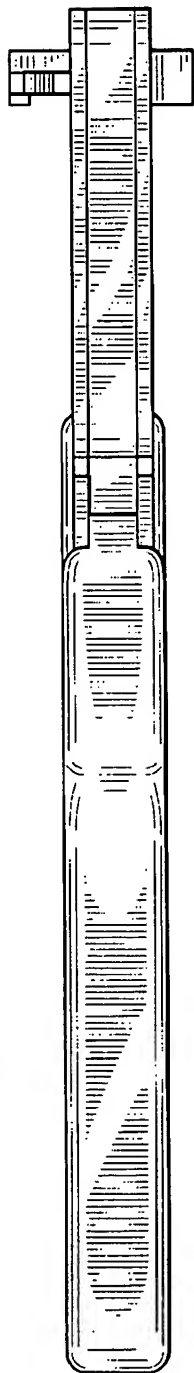


FIG. 5

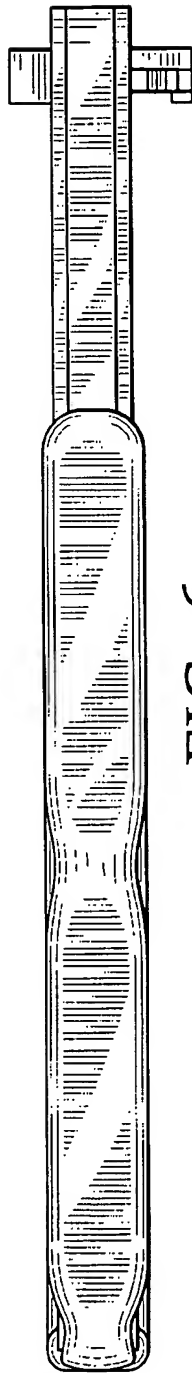


FIG. 6

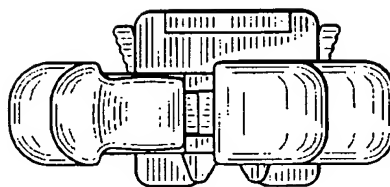


FIG. 8

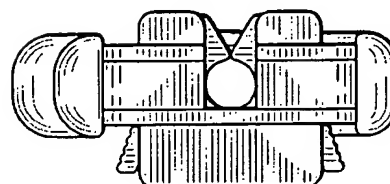


FIG. 7

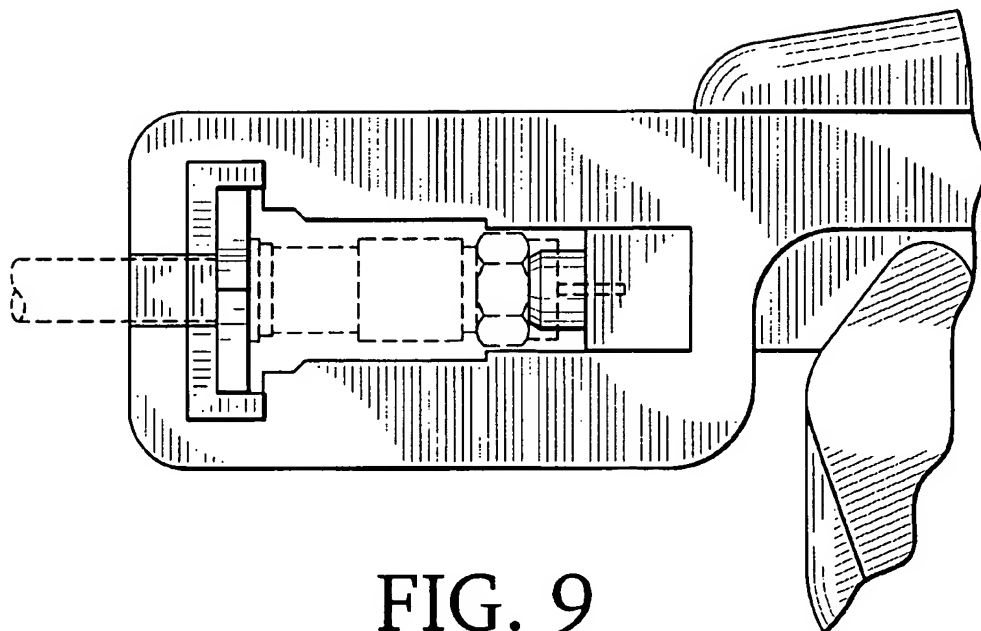


FIG. 9

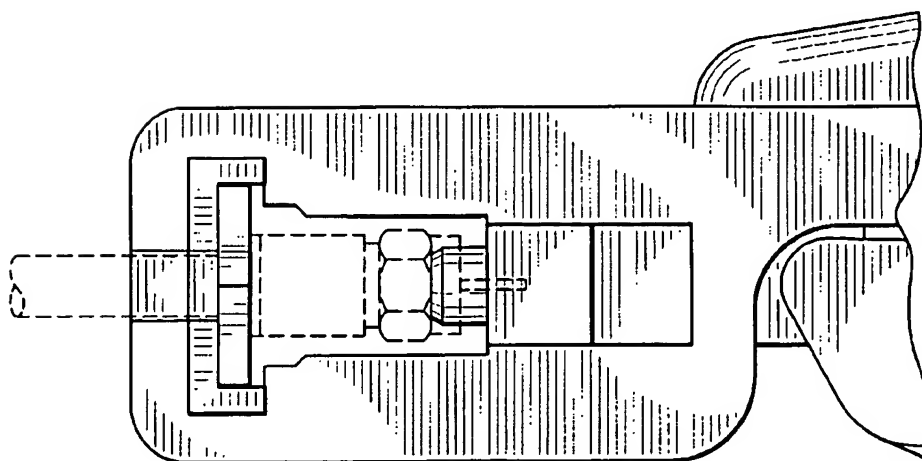


FIG. 10